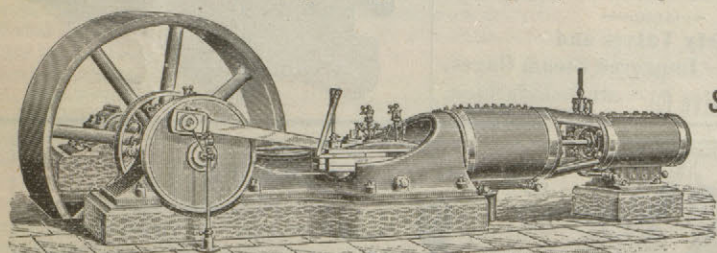


THE BUCKEYE AUTOMATIC CUT-OFF ENGINES

SLOW SPEED, MEDIUM SPEED, AND HIGH SPEED ENGINES.

Simple, Compound and Triple Expansion Engines, and High Pressure Boilers.



Complete
Steam Plants
of Highest
Attainable
Efficiency.

Address BUCKEYE ENGINE CO., 20 Franklin Ave., Salem, O.

Signal Clock....

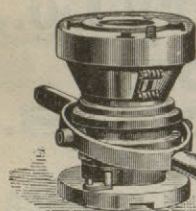
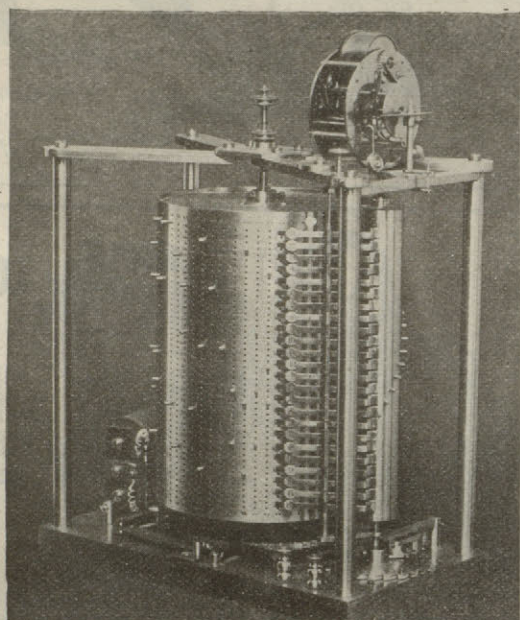
For Starting
Railroad Trains.

In use for many years on
B. & A., N. Y., N. H. & H.,
N. Y. & N. E. and other roads.

Has week day and Sunday
schedules and changes auto-
matically from one to the other.

Blodgett Bros & Co.

383 Federal St.,
BOSTON, - MASS.



THE ACME MACHINERY CO.

Cor. St. Clair and Hamilton Sts.
CLEVELAND, OHIO.

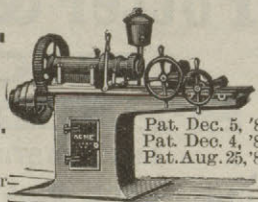
MANUFACTURERS OF

ACME BOLT AND RIVET HEADERS.

Acme Single and Double
Automatic Bolt Cutters.

Cutting from 1/8 in. to 6 in. diameter.

Also Separate Heads and Dies.



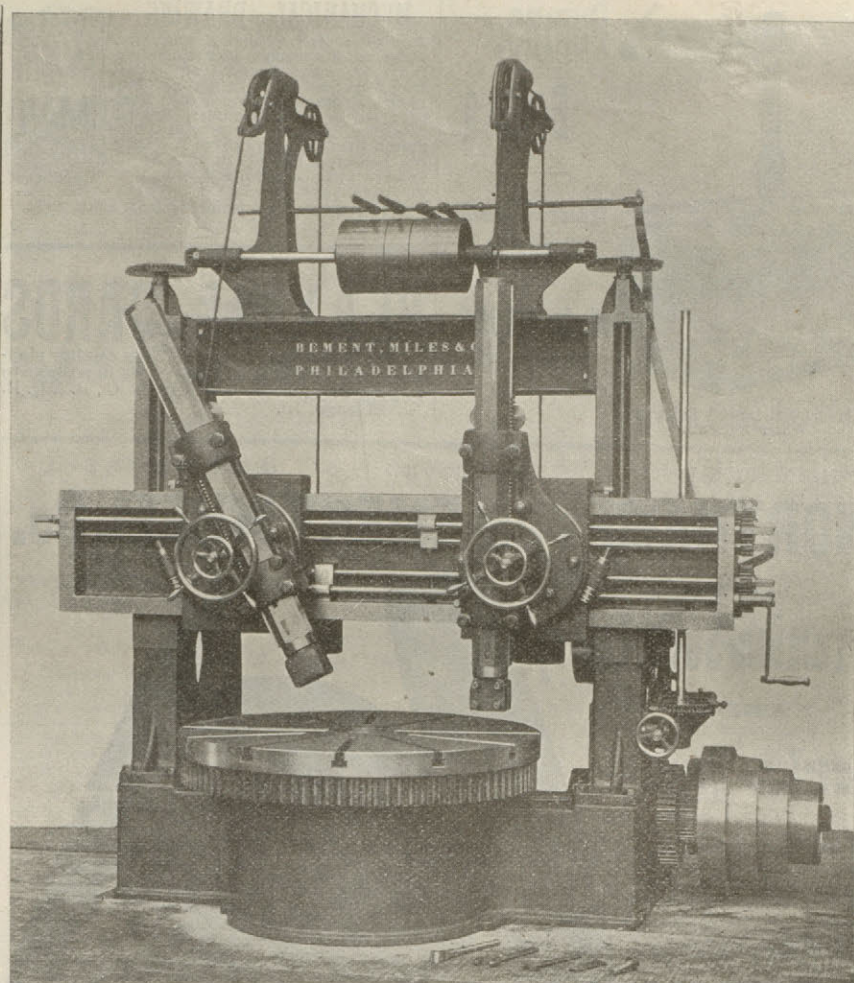
Pat. Dec. 5, '82
Pat. Dec. 4, '83
Pat. Aug. 25, '85

ENSIGN MANFG. CO., Manufacturers of CARS,
For Every Kind of Freight Service.

CAR WHEELS,
Cast in Contracting Chills.

Sole Manufacturers in the United States of RUSSELL SNOW PLOWS.

F. E. CANDA, Pres. O. J. CANDA, Vice Pres. J. W. SAVIN, Gen'l Agent.
11 Pine St., NEW YORK. E. ENSIGN, Sec'y and Treas. HUNTINGTON, WEST VIRGINIA.



Standard 72" Vertical Boring and Turning Machine.

Bement, Miles & Co.,

METAL-WORKING MACHINE TOOLS,
Steam Hammers and Hydraulic Machinery.

Main Office & Works: PHILADELPHIA, Pa.

CHICAGO OFFICE:
1594 Marquette Building.

NEW YORK OFFICE:
39 Cortlandt St.

New Steel Freight Cars.

WRITE FOR PARTICULARS TO

PENNOCK BROS., Manufacturers of Railway Freight Cars, MINERVA, OHIO

CHARLES J. CANDA, Pres. F. MORA CANDA, Treas. FREDERICK HUDSON, Sec'y.
FERDINAND E. CANDA, JOHN W. SAVIN, ELY ENSIGN, Vice Presidents.

CANDA MANFG. CO., Manufacturers of CARS
For Freight and Passenger Service and
CHILLED CAR WHEELS of the Highest Quality

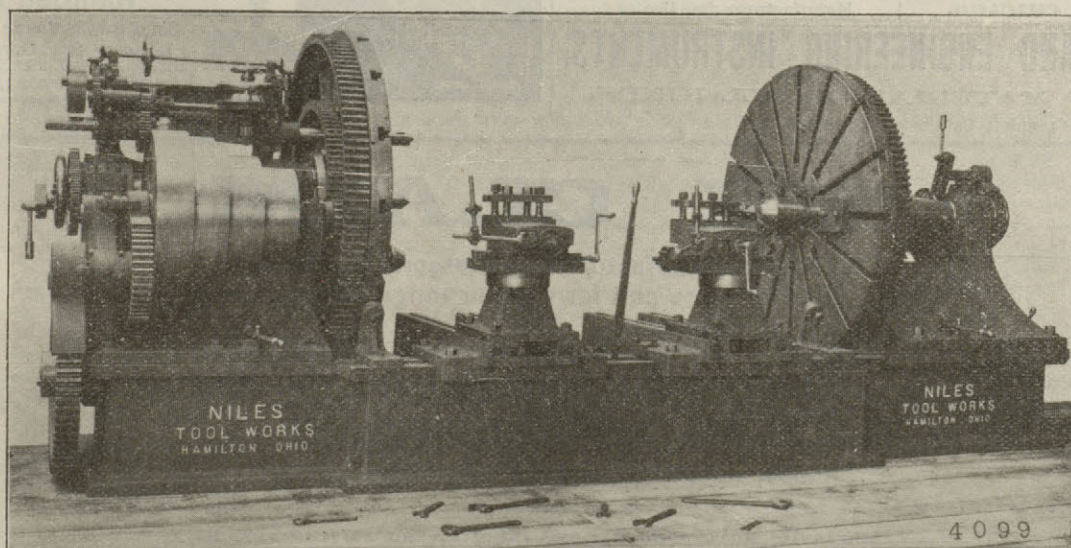
Offices: 11 Pine Street, NEW YORK CITY. Works: Carteret, N. J.

THE NILES TOOL WORKS COMPANY,
HAMILTON, OHIO.

HIGH
GRADE
MACHINE
TOOLS.

Branches:

New York, Chicago
Philadelphia,
Pittsburgh, Boston.



Builders of
MACHINE TOOLS for

RAILROAD, CAR,
LOCOMOTIVE,
GENERAL
MACHINE
SHOPS,
ENGINES and
BOILER PLANTS.

D. O. SETTLEMIRE, President.
GEO. W. EVANS, Vice President.

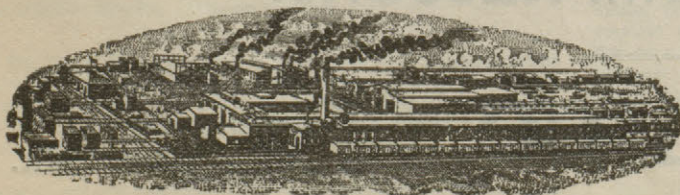
W. C. ARTHURS, Secy. and Treas.
FRANK SNYDER, Supt.

MT. VERNON CAR MANUFACTURING CO.,

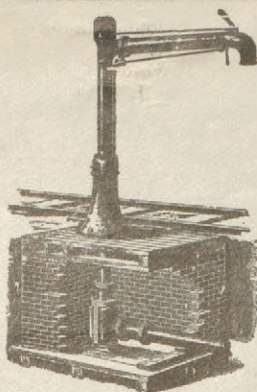
- MANUFACTURERS OF -

Freight Cars of Every Description, Caboose and Refrigerator Cars, Car Wheels, Car Castings and
General Foundry Work. CAPACITY: 15 Cars, and 200 Car Wheels.

MT. VERNON, ILL.



FOLIO
TFI
R4



Moore's Balanced Railway Water Column.

Pumps, Boilers.

Water Stations
Complete.

M. M. MOORE,
225 Dearborn St.,
CHICAGO, ILL.

MECHANICAL DRAWING

Mechanics Architecture; Architectural Drawing. Electricity; Steam Engineering; Stationary, Marine, Locomotive, Iron Work; Railroad, Bridge and Municipal Engineering; Plumbing; Heating; Mining; Prospecting; English Branches. Courses begin with Arithmetic. DIPLOMAS AWARDED. The Largest Technical School in the World. Send for Free Circular, stating subject you wish to study.

The International Correspondence Schools, Scranton, Pa.

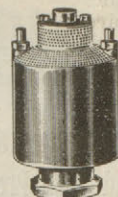


PLAYING CARDS

You can obtain a pack of best quality playing cards by sending fifteen cents in postage to **P. S. EUSTIS**, Gen'l Pass. Agent C., B. & Q. R. R., Chicago, Ill.

THE ASHTON Muffler Safety Valve

The only one with outside top regulation for the pop. Always available. Saves valuable time and expense.



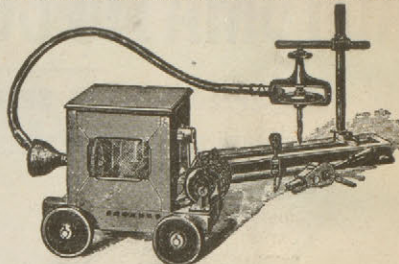
Our muffler patents control the top outside pop regulating principle, which gives increased efficiency and durability.

Open Pop Safety Valves and Improved Steam Gages.

The Ashton Valve Co., 271 Franklin Street, Boston, Mass.

Stow Mfg. Co., BINGHAMTON, N. Y.

Inventors and Manufacturers of the **STOW FLEXIBLE SHAFT** for all purposes. Combinations of Flexible Shaft and Electric Motor.



IRA DIMOCK, Pres.

ESTABLISHED 1867.

G. H. SERGEANT, Treas.

NORTHAMPTON EMERY WHEEL CO.

MANUFACTURERS OF

Premium Solid Emery

AND

Corundum Wheels,

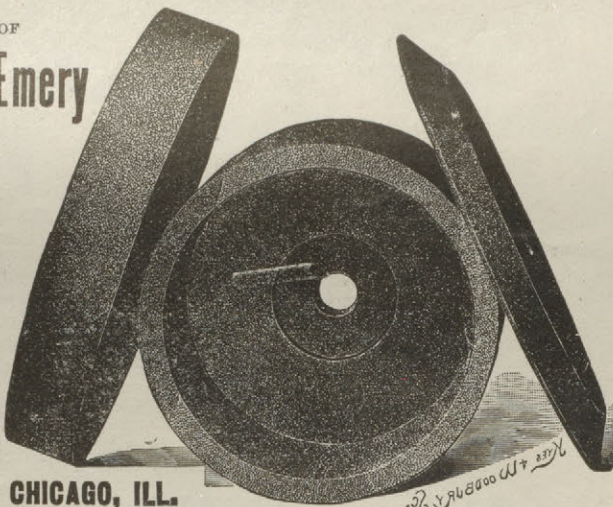
AND ALL KINDS OF

EMERY WHEEL MACHINERY.

LEEDS, MASS.

WESTERN BRANCH

20 South Canal St., CHICAGO, ILL.



JULIUS KELLER.

P. M. WILSON.

KELLER & WILSON,

Manufacturers of

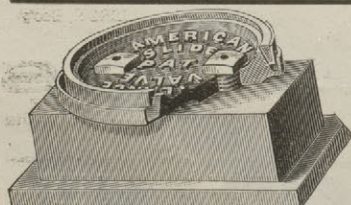
PNEUMATIC TOOLS AND APPLIANCES

For

Caulking Ships, Locomotive, Stationary and Marine Boilers, Beading Boiler Tubes, Cleaning and Chipping Castings, Etc.

Write for Circulars and Blue Prints.

821 Cherry St., Philadelphia, Pa.



Balance Slide Valve

SIMPLEST, CHEAPEST, most DURABLE.

San Francisco, Cal. THE AMERICAN BALANCE SLIDE VALVE CO. Jersey Shore, Penn.



L. MANASSE,

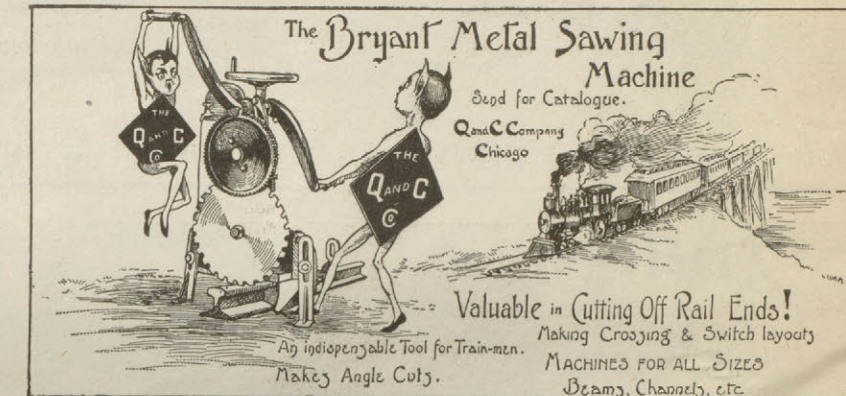
88 Madison St., CHICAGO.

Manufacturer and Dealer in

SURVEYING AND ENGINEERING INSTRUMENTS.

DRAFTING MATERIAL OF ALL KINDS.

Complete Catalogue Sent Free.



The Bryant Metal Sawing Machine

Send for Catalogue.

Q and C Company
Chicago

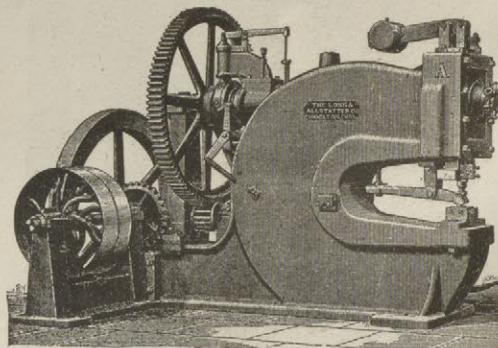
Valuable in Cutting Off Rail Ends!

Making Croosing & Switch layouts

An indispensable Tool for Train-men.

Makes Angle Cuts.

MACHINES FOR ALL SIZES
Beams, Channels, etc.



Heavy Single Machine—Special Gearing.

Long & Allstatter Co. HAMILTON, O.

DOUBLE, SINGLE, HORIZONTAL, BOILER, SPACING GATE, MULTIPLE, BELT AND STEAM DRIVEN

**PUNCHES
AND
SHEARS.**

Send for new Catalogue.
OVER 300 SIZES.

Potter & Hollis Foundry Co., HIGH GRADE STEEL CASTINGS.

LIGHT CASTINGS FROM 1 to 100 POUNDS A SPECIALTY.

Office, 525 Rookery, CHICAGO.



PHOENIX CRANES

THE PHOENIX IRON WORKS CO.

—MANUFACTURERS OF—

Hand, Steam, Belt and Electric Cranes, ALL STYLES AND FOR ALL PURPOSES.

Railroad Turntables, Etc.

Send for Catalogue.

CLEVELAND, OHIO.

Eastern Office, Harry W. Jennings, Agent, Fulton and Cliff sts., New York, N.Y.; and New England Office, The John Wales Company, 139 and 141 High st., Boston, Mass.

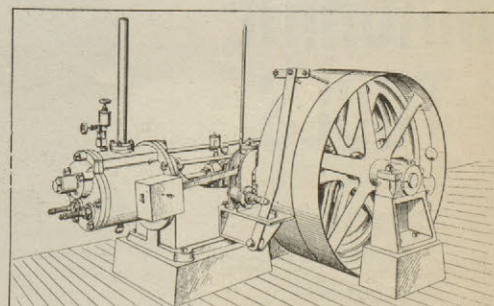
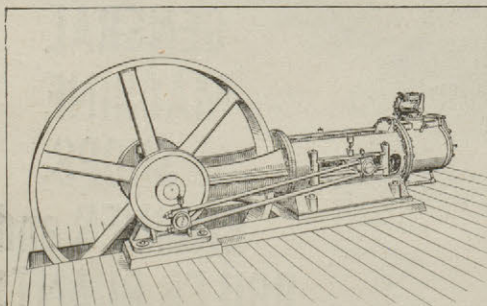
WE CLAIM

FIRST—To manufacture Compressors in greater variety of types and for a wider range of uses than any other house.

SECOND—To have introduced more real improvements—not mere innovations—than any other house.

THIRD—To sell more compressors than any other house, absolutely without exception.

We invite correspondence and inquiries on all the various uses of compressed air.



ROCK DRILLS. AIR COMPRESSORS.

1328 Monadnock Block,
CHICAGO, ILL.

RAND DRILL CO.

100 Broadway,
NEW YORK.

THE RAILWAY REVIEW

XXXVI. FEBRUARY 29, 1896. No. 9.

PLAIN DRAWINGS.—I believe it was George Stephenson who once remarked that every mechanical drawing should be so made that any man who understands such matters should be able to read it without a word of explanation. This is, perhaps, placing the standard so high that few there be who can attain thereunto on every occasion. But the principle remains true, nevertheless, and every draftsman should always bear in mind that the stranger into whose hands his drawings may fall, will probably not be as familiar with the machine that he is designing as he is himself. Usually George Stephenson's rule can be followed to the letter and it is surprising that so many blind drawings are sent out. If a machine is to be sold there is nothing that helps the salesman so much as a drawing or engraving that clearly illustrates its action. Most men are intellectually lazy, and if the drawings are obscure they will make no effort to master the device, and the sale is apt to be lost. Therefore, cultivate clearness in your drawings, just as you do in your letter writing and should do in your conversation.—[J. H. Allen in Dixie.

MORTARS AFFECTED BY FREEZING.—It appears to be ascertained as a fact, based on more than 6,000 recorded results, that Portland cement mortar suffers no surface disintegration under any condition of freezing, but that in most cases its strength is reduced, in some cases by as much as 40 per cent. Rosendale cement is disintegrated when exposed to frost while setting, and its cohesion may be entirely destroyed by immersion in water, which becomes frozen around it. Salt water prevents this disintegration to a large extent, but seems to have an injurious effect upon the strength, and the cement below the disintegrated surface is stated to be increased in strength when the Rosendale cement is used. A mixture of a natural rock cement and of Portland cement is found to give very satisfactory results, as its surface does not disintegrate, and its strength is increased by the freezing. Portland cement is injured less proportionately as the percentage of the cement in the samples is reduced. Again, though lime mortar is ruined by alternate thawing and freezing, fairly good results may be looked for in the case of brick masonry when the mortar is kept frozen for some time after laying.

RAILWAYS IN HIGH LATITUDES.—The northernmost railroad in Europe is the Swedish State Trunk Line from Langsall to Boden, upon which work has been proceeding from 1887 to 1895, and which has a mileage of about 310 miles. The line passes through vast forests and crosses the Angerman river and several other large rivers. The country is only in a few places cultivated and very sparingly inhabited. The preparatory work commenced in 1883, and was attended by considerable difficulties, as there were several lines under discussion, and the various lakes and rivers over which the line had to be carried also necessitated careful investigation. The result of protracted surveys was, however, a reduction in mileage of some 45 miles. The whole line with rolling stock, etc., will cost about 26,000,000 kr., or about £1,450,000. The earthwork comprised about 5,706,000 cubic meters and 126,000 cubic meters of rock blasting. There are altogether 78 bridges, the largest of which is across the Angerman river; it is about 900 ft. long and 125 ft. above the river.

THE ADVANTAGE OF BEING A BLACKSMITH.—Among the seven trades which a student in mechanical engineering must learn at Cornell is that of the blacksmith. Occasionally there is a protest, but it is never heeded. One dude ten years ago was unusually averse to soiling his hands. But he had to work at the forge just the same. Last fall he went to Professor Morris and thanked him for being compelled to learn blacksmithing. "Why?" asked the professor. "Why you see," replied the former dude, "I am now superintendent of a mine away back in Colorado. Last summer our main shaft broke, and there was no one in the mine but myself could weld it. I didn't like the job but I took off my coat and welded that shaft. It wasn't a pretty job but she's running now. If I couldn't have done it, I'd have had to pack that shaft on mule back and send it 300 miles over the mountains to be fixed, and the mine would have shut down till it got back. My ability to mend that shaft raised me in the eyes of every man in the mine, and the boss raised my salary."—Scientific American.

WHAT THE TANK SAID.—At a recent meeting of one of the engineering societies of Great Britain, Archibald Denny of the famous firm of Denny Bros., scientific ship builders of the Clyde, stated that when his firm desired to build paddle steamers for the Belgian government they experimented in their tank with a vessel 300 ft. long by 35 ft. beam, and found that the best speed was 19½ knots, but ultimately discovered that by merely by adding 3 ft. to the beam the speed was increased to 20½ knots, the draft being the same—8 ft. 6 in. This unexpectedly high speed induced the Belgian government to give them the order. Later when a still higher speed was required, the Belgian government allowed them 340 ft. in length, and were immensely surprised when the beam was made as before—38 ft. The only reply Messrs. Denny made was that the tank said so, that it was bound to be true, and that they were willing to guarantee results.—Marine Review.

STAINING WOOD BLACK.—A process for staining wood black, which is given in a recent number of the *Badische Gewerbe-Zeitung*, consists in painting the wood consecutively with copper sulphate solution (1 per cent) and an alcoholic aniline acetate (equal parts of alcohol and acetate.) A very durable black—and the nearest approach to real ebony—is readily obtained by moistening the surface of the wood with dilute sulphuric acid (1.20), and subsequently applying heat. A temperature of 60 deg.—90 deg. C. suffices in a very few minutes to produce the desired re-

sult. An excellent black was obtained in this way on beech, bass, and boxwood; while a second treatment with acid was necessary in the case of cherry, walnut and birch. With oak and ash the results were not so good; and apple and different varieties of pine were still less amenable to the process, pine especially being unevenly stained. In order to afterwards remove the acid from the wood, it might be well to thoroughly wash the latter with dilute soda solution, followed by clean water. It is unlikely that this method can be applied to any but small articles, because of the risk of possible fracture during the necessary heating of the wood.

RAILWAY FEAT IN JAMAICA.—An American firm which has just finished the connecting link of 50 miles in the chain of railroads encircling the island of Jamaica, has performed a great feat in engineering. The road runs entirely through mountains and morass. It has 27 tunnels, 193 girder bridges, 13 viaducts and 11 tower bridges. It is said that no such tremendous obstacles were ever met by engineers in a 50-mile stretch. The cost will average more than \$100,000 a mile.

PASSENGER TRAFFIC ON EUROPEAN RAILWAYS.—A recent report to the Railway Tariffs Committee in Italy gives some detailed figures as to the mileage and number of passengers on the principal railways of Europe, which are as follows:

Name of country.	Miles e.	Number of passengers per annum.	Number of passengers per 100 of the population.
Germany.....	26,250	483,000,000	978
France.....	23,750	305,000,000	706
Gt Britain and Ireland	20,625	864,000,000	2,282
Russia.....	18,100	33,000,000	33
Austria.....	9,375	85,000,000	355
Italy.....	8,750	51,000,000	171
Hungary.....	6,850	37,000,000	214
Belgium.....	2,875	37,000,000	1,426
Switzerland.....	2,185	37,000,000	1,259
Holland.....	1,875	33,000,000	726
Roumania.....	1,500	5,000,000	95

With the exception of Russia and Roumania, Italy has fewer railway passengers per head of the population than any of the other countries, and Signor Bodio adds that, while of the available seating accommodation in trains 35 per cent is occupied in France, 28 per cent in Belgium, 27½ per cent in Switzerland, 27 per cent in Hungary, and 25 per cent in Germany, only 23 per cent is occupied in Italy.

STIPULATIONS ON BILL OF LADING.—The case of Maxwell vs. the Southern Pacific Railroad Company has recently been decided by the supreme court of Louisiana. The action arose upon the attempt to recover the value of 110 bales of cotton that were destroyed by fire while in possession of the defendant at its depot or the vicinity thereof, in New Iberia, the same having been delivered to defendant for transportation over its road from the parish of Vermillion to the city of New Orleans. The court held that a stipulation in a bill of lading for the transportation of cotton in bales by steamboat and a railroad as a connecting carrier for hire, that neither shall be responsible for damage which shall be occasioned by fire, does not exonerate either from responsibility for such damage as shall result from fire that is occasioned through the fault or ordinary negligence of the agents, servants or employees of the carrier; that notwithstanding such a stipulation in a contract of affreightment, the carrier is bound to use due care and watchfulness in the protection and safe delivery of the goods of the shipper, and if the care demanded was not exercised the case is one of negligence, and a legal liability is made out when failure is shown.

ROCKY MOUNTAIN STREAMS.—Western engineers are beginning to realize that the water power running to waste in the Rocky mountains will furnish not only food for reflection, but the more material force necessary to turn the wheels of agriculture, mining and commerce on the slope to an almost unlimited extent. A practical beginning of utilizing these streams has already been made, and it will be a misfortune if Pacific coast cities fail to become competitors for these future manufactories. The mountain streams only a few miles distant can be made to furnish ample power at moderate cost. The facilities for transportation by water render those cities much more desirable places for manufacturing establishments than interior points. Immense power is sleeping in the Healdsburg canon, good for 10,000 horse power. There is enough water going to waste over the submerged dam near La Grange, Cal., to run 100 miles of electric railroads to near-by cities and towns. As it is now the power of that mighty force of water is going to waste. That dam is only one of many which may be built for the purpose of irrigation, which may also be used to generate electric power for railroads. The whole western slope of the Sierra Nevada drains an almost incalculable amount of water, which is gathered, according to the water sheds, into creeks and rivers. There is the Merced river, which has fall enough to supply enough power to operate an electric road to a point on the bay of San Francisco. The same is true of the Fresno river and the San Joaquin, the King, the Tule and the Kern rivers. All those are great rivers with capacity of generating great power, which may be used for electric roads or for manufacturing plants. California cannot be too prompt to make commercial use of the power in her streams to provide it with electricity. The first great experiment—on the American river at Folsom—is successful. A hundred other schemes for putting traces and collars upon the moving waters are in the air. From Lake, from San Diego, from Kern, from Calaveras, come reports of projects to make the waters do the hard work for man. Use of water for power for the electric road to be built to the Yosemite Valley is entirely within possibility, and the visitor to the wonderland may ride swiftly by the force of the very waterfalls that enchant his vision at the end of the trip.

THE USE OF ELECTRICITY IN CASTING METAL.—The cooling of molten metal in the ladle before it has been poured causes a loss of time and money, for the metal that has cooled must be removed and remelted. In order to remedy

this evil an attempt has been made to keep the metal in casting condition by conducting an electric current through the ladle. This test furnished a result which exceeded all expectations and appears, according to Lueders' Patent Bureau, at Goerlitz, Germany, worthy of general notice. The electric current was hardly turned on when the molten metal became violently agitated and the temperature so high that the mass emitted an almost blinding glare. The men employed in the test, having omitted to provide themselves with spectacles, contracted inflammation of the eyes. Although the test did not lead to a practical result, it was established beyond any doubt that the idea, to keep molten metal by means of electricity in casting condition, is practicable, and that there is nothing required for its realization but an accurate regulation of the power of the current.

PORTABLE STEAM HAMMERS.—A most useful tool for shipyards is the portable steam hammer for welding up stern and rudder frames. It has always been a most difficult and rather imperfect operation to unite these parts properly by hand hammers, and they are usually too broad to be accessible to the ordinary fixed steam hammer. Two large parts of a stern frame have usually to be heated in situ, while placed together in the position which they are to occupy when welded. They are heated at the parts of the junction in open fires. When brought up to a welding heat the fires have to be withdrawn quickly, and the piece called a "glut" is brought at a welding heat from another fire, and is hammered into the space where the joining takes place. This has usually been done by a heavy sledge hammer having three or more shanks, and handled by as many men. But by this mode the welding is very unreliable. The hammer is much too light to make a solid weld, and the work is done at a great disadvantage, and with harassing labor. The portable steam hammer has altered all this. It resembles the ordinary smithy steam hammer, except that, instead of the cylinder being attached to a fixed column, it is carried by a jib, like a crane, can be raised or lowered, swung around, or moved to and fro until it is exactly over the work, and by a few heavy blows the welding is done most effectually. The workman who manipulates the hammer and the racking gear is stationed at the base of the crane, quite out of the way. The movable steam hammer has rendered the welding of stern frames and similar forgings quite an easy and satisfactory operation. It was first brought out by Messrs. Bennie, of Glasgow, and was first set to work on stern frames in the works of the Parkhead Forge Company, of that city. The kind of work this hammer does could not easily be executed by a hydraulic press.—J. Arthur Gray, in Cassier's Magazine.

METALLIC CEMENT.—An easily fusible metal composition is now being put upon the market in Zurich, Switzerland, under the name of "patent metal cement." This metallic cement melts like lead at about 250° C. and can be cast into the most delicate molds; in addition to this, it sticks like glue to all substances, as stone, masonry, metal and wood. It is almost entirely proof against water, acid and oils, so that it appears well suited for repairing leaks in oil tanks and pipe conduits. This cement possesses a great power of adhesion, because it extends somewhat during cooling off. Another advantage of the new metal is its small specific gravity of but 1.5. For use it is broken up in small pieces and molten in an iron kettle over a moderate fire, until the mass has become thinly liquid. For casting small objects, molds of plaster of Paris, clay or sand can be used.

THE COG WHEEL RAILWAYS OF THE WORLD.—The Temps publishes some interesting particulars with regard to the number and length of cog wheel railways, stating that 70 lines have been built since 1812, and that of these 17 are in Switzerland, 14 in Germany, 12 in Austria-Hungary, 4 in France, and 3 in Italy, and others being in England, Spain, Greece, Portugal, the United States, South America, Asia and Australia. The total length of these lines is 500 miles, of which 188 are on the Abt system. These lines are worked by 300 locomotives, the heaviest of which weighs 70 tons.

Amendment to the Rules of Practice of Patent Office.

The following amended regulations for the conduct of proceedings in the patent office have just been published:

65. An applicant will be considered to persist in his claim for a patent without altering his specification in case he fail to act in prosecution of the same for six months after the office action thereon, and thereupon the examiner will make a re-examination of the case.

134. In appealable cases in which no limit of appeal is fixed no appeal will be entertained by any tribunal in the office unless taken within six months from the action which puts the case in condition for appeal, unless it be shown to the satisfaction of the commissioner that such delay was unavoidable.

68. In every case pending before the office more than five years, in which the record raises the presumption that there have been intentional delays in prosecution, the examiner may require the applicant to show cause why the case was not more rapidly prosecuted, and at the hearing thereon, or upon failure of the applicant to appear, the examiner will determine, under all the circumstances of the case, whether there have been intentional and unreasonable delays in prosecution, and upon finding the fact to be so, he will reject the case for that reason. Present rules 65, 69 and 134 are repealed and present rule 68 is re-numbered 69.

The foregoing rules will be in effect on and after April 15, 1895, and will affect pending cases as though the last office action were upon said date.

PUBLISHERS' CATALOGUES.

This office would be pleased to receive from manufacturers and publishers such catalogues, circulars, price lists or other advertisements relating to the sciences and mechanical arts as are published by them for gratuitous distribution; but notice is hereby given such manufacturers or dealers who feel disposed to send their publications, that not less than three copies should be forwarded in order

that the subjects may be properly indexed, classified and subclassified in the Scientific Library for convenient and ready reference.

A RAILWAY BRIDGE AND BUILDING DEPARTMENT.

ONWARD BATES, M. AM. SOC. C. E., M. INST. C. E.

(Continued from page 100)

Regarding standard plans, I warn you against a hasty adoption of standards. A safe method is to test a proposed plan with one season's work and then adopt it as standard after you have corrected the faults revealed by a year's experience. One of the greatest sources of economy is the duplication of work, and this can best be obtained by the proper selection of specifications and standard plans, and strict adherence to them. Do not generalize from insufficient data. That is a common mistake of the practical man, although the theoretical man is by no means exempt from it, and in either case the younger the man the more he builds upon his experience. Old engineers are more conservative. They learn that circumstances alter cases. If it is, for instance, the question of accounting for the durability of piles, they will consider what were the conditions that gave the piles in question a long or short life. They will find that the durability of a pile is affected by the soil in which it is grown and the soil in which it is driven for use, and also by the climate, the state of humidity having more or less effect upon it; the season in which the pile is cut; the effect of peeling the bark when it is green, and other conditions which may become apparent upon investigation. If the pile is attacked by worms just below the surface of the ground, it will be a question of where these worms came from, and whether piles of a similar kind in other localities are likewise affected. It will take in any single question a very extended experience to arrive at the proper conclusion, and even then the chances are that it will be impossible to bring all of the conditions into one final rule, making several cases for reference instead of one. I suggest that you test this statement when you get into a bridge and building department by writing a question and sending it to a number of practical men for replies, and then compare the replies received. I have frequently made the experiment and received such contrary replies that it was difficult to average them. In forming judgment as to the value of material, try always to base it on the actual conditions which exist. Take as an example, laboratory tests of the strength of timber, based on selected specimens of small sizes, free from season checks, knots, rotten places, wanes, shakes, and moisture, and you will find them very misleading if applied to the actual conditions of timber in service.

I advise you, whether engaged in this or any other department to acquire the habit of checking everything. If it is a computation always check by doing it in two ways. Check the results of any extended computation. For instance, check your stresses in a bridge truss by end reactions and middle chord stress. If this habit of checking is acquired, it will surprise you to see how many applications can be made of it, and what an advantage it is in passing upon the work of others, and what a gain it is in the accuracy of your work. The habit of checking once acquired will go with you all through your engineering practice, and your business practice as well, and its full value will be apparent only with its application. One of the chief duties of a superintendent of bridge and building department is to study economies. His department is peculiarly liable to be wasteful, because upon our western railways at least, most of the structures are of wood, which is a perishable material. These structures are also of a temporary nature, liable to be destroyed by floods or fire. The replacement of temporary structures requires that the department shall carry a stock of timber and piles, distributed over the road, and it is quite a problem to keep the right stock on hand and not to be short of material when it is needed, nor to have a wasteful surplus.

It is an equally difficult problem to distribute your material with the least amount of transportation, in such a manner that it will be where you want it at the time it is needed. In theory, materials of construction should never be handled both ways over the railway. In practice it is "deadhead" freight, and because there are no charges on it the department falls into a way of assuming that it costs nothing to haul it back and forth. This results in heavy expenses for transportation which are unnecessary. It is even more difficult to plan for the repairs and other work on the railway in such a way as will bring about the least amount of traveling for the workmen. In these and similar cases economies should be studied by all employees of the department from the workmen to its head, and the latter should devise such systems of reports and checks on the expenditures, as will secure the concerted action of the whole department in one common purpose.

The discussion with reference to contract work was not intended to apply to the purchase of supplies. If it did, the principle might be carried to an injurious extent. All surplus of supplies should be avoided, and it is not the province of the bridge and building department to speculate on advances in prices for material and supplies which can be readily obtained. The

stock carried by the department should be sufficient only for present needs, with perhaps a slight addition for emergencies. It is not reasonable for the department to undertake to compete in the manufacture of specialties with outside concerns. Sometimes it may be advisable that a specialty which has been recently introduced in the market be manufactured by the company in order to compel reasonable prices from outside manufacturers, but when an article has become standard, there is enough manufacturing capital to take it up and secure the competition that will bring reasonable prices, and the quality is to be secured by the department's method of inspection. There are certain repairs of special articles which may profitably be made by the department, and it is this requires the maintenance of a shop, it may be advisable to manufacture selected specialties in order to provide stock work for the shop. There are also cases in which old material may be worked over again at slight cost, giving it the value to the company of new material, and in the study of economy, this old material should be cared for as carefully as if it were new material.

In designing work it is usual for an engineer to consider only the materials which enter into the construction of the work. In the maintenance of engineering structures on a railway he must consider in addition to the materials of construction, the machinery and tools used in the construction and maintenance, and the workmen of different degrees who are employed by the department in its work. The last consideration is perhaps the most important of all in a business which involves so great a variety of work, and scattered as it must be, over the whole length of the company's lines. The young engineer starts first with materials, then he must consider appliances, and then men, and when he himself has reached the head of a bridge and building department, he must know how to handle all of these elements individually and collectively. That is the best policy in the management of men which gives scope to individual effort, and provides individual rewards. Competition is said to be the life of trade. We reap the benefits of competition in the purchase of supplies; and equally great benefits will result from competition among employees. This competition to be effective must be restrained within the channels which are open for advancement of the employees, but these channels should be as many and as accessible to employees as possible. Every man, whether in high or low station, is bound by his obligations to the company, as well as by the moral obligation to his fellow men, to do all he can in making the way of advancement clear and open to others, and it is entirely compatible with discipline and loyalty for employees to strive for advancement through improvement in the quality and quantity of work.

I commend to you as good reading, a paper read by Mr. F. W. Taylor before the American Society of Mechanical Engineers some months ago, and which has been copied in nearly all of the engineering publications. Mr. Taylor's paper treats of scientific rate making, and he makes it very plain that in piece work the price should increase with the performance. For example: a man who makes 20 pieces per day should get more per piece than a man who makes 15 pieces per day, and the same rule holds good of course with respect to quality. I do not intend to discuss piece work at this time, but the subject as discussed in the paper I have mentioned treats of a general principle which applies to the employment of all men. Correct principles for controlling and directing employees will apply in the bridge and building department as well as elsewhere, but there is one consideration which makes the service of the bridge and building department differ from other occupations of a similar nature, which is that the work is distributed over a great territory. This removes it from the immediate supervision of the head of the department, or his principal assistants, and dependence must be placed on foremen and workmen. A workman who is efficient in a shop where all of his work is laid out for him, and all of his actions are controlled, may not be fit to serve in a bridge and building department, where he carries responsibility, and where it may happen that the humblest employee has to make a decision with respect to the condition of a structure which involves the safety of passenger trains. The requirements of the service and the responsibility which employees must take, have resulted in securing for this branch of the railway service a superior class of workmen. This is as it should be, and since all personal improvement of individual employees must benefit the company's service, it should encourage its employees in all their efforts for improvement.

My paper has become sufficiently long, and I will close it by leaving with you the following propositions:

1. That the maintenance of a railway includes everything necessary to keep it in running order; all inspection and repairs; all changes from temporary to permanent work; changes for convenience of operation; all the improvements, additions and extensions, except the construction of new lines.

2. That the expenditures for railway construction, that is, for new railway lines, will, in this country, henceforth be small in comparison with the ex-

pensitures for the maintenance of existing lines.

3. That the maintenance of a railway is an engineering problem, and that the head of the maintenance department should be an engineer.

4. That the two main divisions of the maintenance department are maintenance of way, and rolling stock and machinery; maintenance of way being sub-divided into the bridge and building department and track department.

5. That the bridge and building department is the most important branch of railway maintenance, and calls for a greater amount of technical knowledge than any other branch of the railway service.

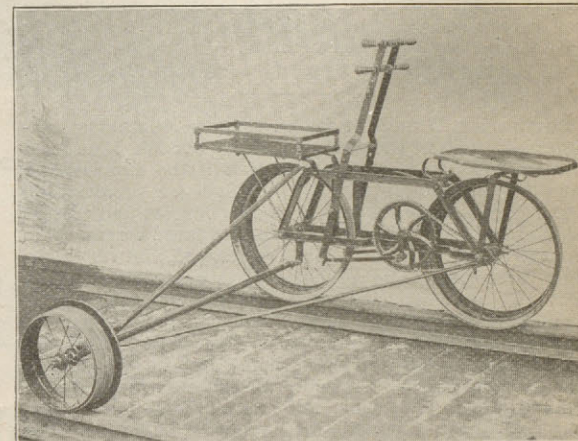
6. That conditions are changing and will continue to change, with the result that increased importance will be attached to the bridge and building department because of the large expenditures through it simply to keep the machine in condition to do business, and that owing to the diversified nature of its work, the same checks cannot be placed upon it that will apply to other branches of the service, and reliance must necessarily be put upon its employees, and that its employees must be educated to meet the new conditions.

7. Assuming the foregoing propositions to be true, there will be in the future, greater demand in the bridge and building department for the services of engineers.

8. Finally, that the position in which a young engineer should commence in railway service is at the bottom of the scale in the bridge and building department.

KALAMAZOO HIGH GRADE VELOCIPED CAR.

The accompanying illustration is reproduced from a photograph which represents the latest development in the railroad velocipede car as manufactured by the Kalamazoo Railroad Velocipede & Car Company of Kalamazoo, Mich. This company some months ago brought out a railway "safety" which weighs only 55 lbs. and is built on practically the same lines as the safety bicycle, and in the new veloc-



ipede the same style of light tangent spoke wheels ball bearings, etc., are used. The large wheels are 20 in. and the small one 11 in. in diameter, each being encircled by a rubber band $\frac{1}{8}$ of an inch in thickness. The guide wheel arms are of steel tubing and may be folded up at the side of the car for compactness in shipping. The frame is of channel steel. The machine is geared 4 to 1. The weight is only 90 lbs., and it is claimed that a speed of 12 to 15 miles per hour may easily be obtained on a level track. A convenient tray for luggage or tools is attached in front. The car is particularly designed for use by inspectors or line foremen.

THE CARE OF AIR BRAKES.

In the discussion on air brake equipment before the Western Railway Club, Mr. J. F. Deems, master mechanic of the Chicago, Burlington & Quincy Railroad at Ottumwa, Ia., contributed some information in regard to the care of air brake apparatus, of which the following is the substance:

In June, 1894, we had our repair yards piped for air and all arrangements made to test and care for the air-brakes in a systematic way, and in order to have the work properly carried out I posted a set of 12 or 13 rules for the guidance of our car men, one of which read as follows:

Car inspectors must keep a lookout for the stenciling on triples and cylinders of Burlington route cars and when this stenciling does not show the parts to have been oiled, cleaned, etc., within the time fixed by the M. C. B. code, the car, if empty, should be marked "Bad order" and sent to the repair track to receive necessary attention. In carrying out this rule proper consideration must be given as to whether the repair track force is able to do the work, also as to whether the repair track force is able to do the work, also as to whether the car can be spared from the service or not.

After watching the operation of these rules for a month or two, I was surprised at the number of cars not stenciled to show the date of cleaning, or bearing date showing this work had not been done for three or four years; and in order to get some definite information on this point I placed in the hands of the foremen a blank form to be filled out each time the cylinders and triples were cleaned, and as an after-thought I arranged to show on this card the condition of the cars when sent to the repair track under three heads, viz., "Fair," "Bad," and "Very Bad," and to also show date of last cleaning as per stencil, it being understood that under the heading "Fair" all

cars should show on which the brakes were in average service condition; under "Bad" would be included those on which the brakes worked, but so sluggishly that if in a train with other cars on which the brakes were in good condition the action would be very irregular and cause "rough handling" of train; "Very bad" would cover all cars on which the brakes would not work at all or so badly as not to be fit to run.

In February, 1895, I checked over these reports for the last four months of 1894 and found 150 cars had been attended to. We found that of the 150 cars, 37 cars, or 24 per cent of the total, seem never to have been cleaned at all, and of this 37 cars, 24 or 65 per cent show under "Very Bad." Four cars were found marked "cleaned" in 1890, all of which show under "Very bad." Fourteen cars for 1891 are the same.

When we come to 1892 we find matters a little better; of the 44 cars, 11 per cent are "Fair," 39 cent "Bad" and only 50 per cent "Very Bad," as against 100 per cent in the two previous years. And for 1893 there is a decided improvement. Of the 51 cars bearing that date we find 56 per cent "Fair" and only 5 per cent under "Very Bad." Another significant point shown by these figures is, that of the total of 150 cars only 51 or 34 per cent had been cleaned within the time limit fixed by the M. C. B. Association.

It seems to me these figures point out two facts: First, that the time limit of one year adopted by the M. C. B. Association is none too short, or in other words that one year is long enough to let triples run without being cleaned; and second, that up to the early part of 1895 but little attention had been paid to following the rule laid down by the M. C. B. Association on this point.

Almost without exception the report would show under the heading "Principal Defects" that the presence of dirt and grit in the triple was at the bottom of the trouble and, notwithstanding all that has been said about defective air-hose and the ninety and nine other ills than the air-brake system is heir to, I believe this one item is of more importance than all the others combined. Through it comes the irregular action of the triple and in the train of this will be found "Damaged Freight,"

common practice in connecting these pipes, and the broken lines show a method in making a connection that I believe would assist quite a little in keeping the triples clean. If it is good practice to put the tank drain cup on so as to retain the moisture and dirt in the cup instead of assisting it to pass into the train pipe and thence to the triple why is it not equally good to do the same with the car drain cup? There are no practical difficulties in the way of applying the piping as I have suggested if it is the best practice, and if there is any reason why it is not the best practice or why it should not be done I have never heard it and would like to have some one enlighten me on that point. There is the objection that it adds another elbow near the triple, but I believe this does not count for much as compared with the advantages gained.

BALDWIN LOCOMOTIVES FOR THE VLADICAUCASE RAILWAY RUSSIA.

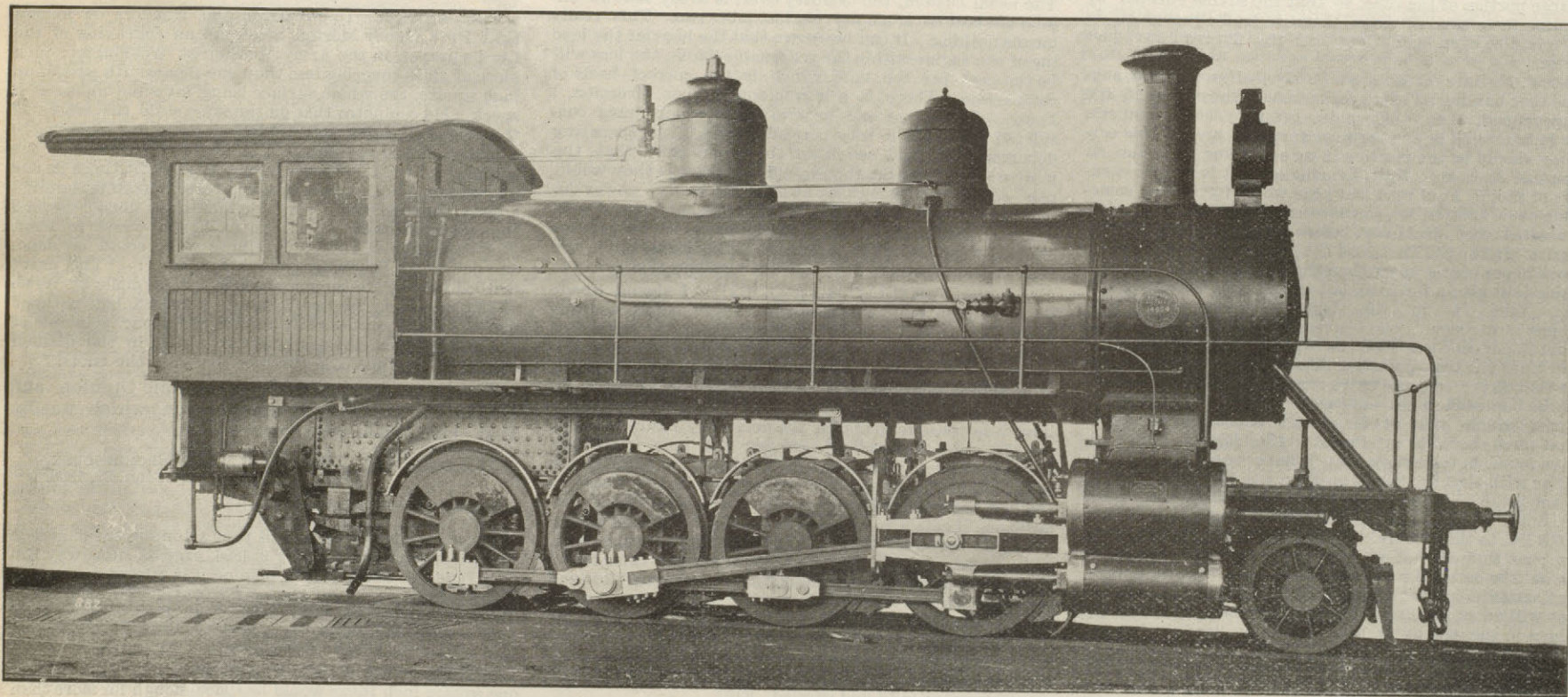
The accompanying illustration shows the general appearance of the freight engines which have recently been built by the Baldwin Locomotive Works for the Vladicaucase Railway of Russia, and which are now being loaded on the steamship Adra. This road has 807 miles of track in operation and 95 miles under construction. The engines are fitted for burning oil like those of the ten-wheel type which were illustrated in the RAILWAY REVIEW of last week, and which formed a part of the same order to the builders. The designs in the main are similar, the boilers both being straight and the cylinders are compounded on the Vaucrain system. The freight engines are of the consolidation type and the arrangement of equalizers is different from those employed on the ten-wheelers in that the springs of the freight engine are placed above the boxes.

The general dimensions of these engines are given in the following table:

LOCOMOTIVE SERVICE.

The paper upon locomotive service read by Mr. J. H. McConnell, superintendent of motive power of the Union Pacific Railway, before the Western Railway Club, and printed in full in the RAILWAY REVIEW of January 18, 1896, was discussed at the January meeting, the subject being introduced by Mr. J. C. Stewart of the Chicago & Northwestern Railway, who explained, by the aid of a diagram, the reason for the fact that the actual average load of a freight car was but a fraction of the total capacity. This was stated to be on account of the necessity of meeting the requirements of shippers and of competition. The following abstracts are given of the discussion:

Mr. E. M. Herr (C. & N. W.)—While the cost of the fuel per engine mile is increased, if it is figured as is undoubtedly the most correct way to figure it, and which is very clearly brought forth in the paper, on the car mile, or still better, the ton-mile basis, I think it will always be found that a reduction in cost per ton mile has been made by increasing the average load. It does not, however, follow that the engine should be loaded heavily to produce the most economical results, or that the cost for repairs and fuel can be entirely neglected, although I think there are other conditions that enter in, which will bring down the economy of this kind of operation still more than the increase of repairs. As you increase the tonnage that each engine is expected to haul, you necessarily decrease the ability of that engine to make time over the road, and it seems to me that it is quite possible to increase the tonnage that is put upon the engine to such an extent that, owing to the longer time that it takes for this engine to get over the road, you will show an actual increase in cost of operation, and a consequent detriment to the service, instead of a gain. I know this was the case in an experience I had one time when I was in the transportation department. Anxious to move as much freight as possible we loaded the trains



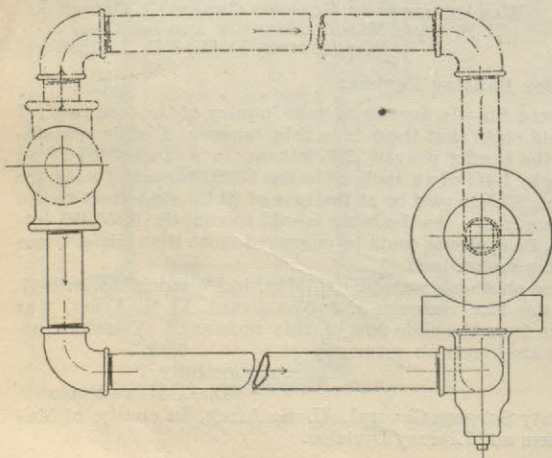
FREIGHT LOCOMOTIVE FOR THE VLADECAUCASE RAILWAY, RUSSIA—BALDWIN LOCOMOTIVE WORKS.

"Trains Parted," "Cars Damaged," "Personal Injuries," etc., etc.

It might be claimed that these figures reflect only the condition of Burlington route cars and that others are very much better, but my observation convinces me that there is not much foundation for this claim.

When considering this matter the question that naturally comes up is, can anything be done to keep even a portion of the dirt and grit out of the triple? And in this connection I will say there is one thing that has suggested itself to me many times, that is the manner in which we connect the train line to the triple by leading in a downward direction from the drain cup.

On almost all cars the train pipe inclines downward from the end of the car to the drain cup and then by having the branch pipe lead off in a downward direction from the cup to the triple it would certainly seem that a special effort is being made to carry to the triple as much moisture and fine dust as possible. I have here a rough pencil sketch showing what I mean. (Shown in the accompanying illustration.) The black solid lines show the



Cylinders.....	h. p. 13½x26; l. p. 28x26
Driving wheels, cast steel centers, diameter.....	44 in
Driving wheels, outside diameter.....	50 in
Driving axle journal, diameter.....	8x9 in
Total wheel base of engine.....	21 ft. 4 in
Driving wheel base.....	13 ft. 5 in
Gage of track.....	5 ft
Diameter of tubes.....	2 in
Number of tubes.....	259
Length of tubes.....	13 ft. 6 in
Fire-box—	
Length.....	81 in
Width.....	45 in
Material.....	copper
Thickness of sheets, side and back.....	½ in
Front flue sheet.....	½ in
Back flue sheet.....	¾ in
Crown sheet.....	¾ in
Stay-bolts.....	copper
Heating surface—	
Flues.....	1,837 sq. ft
Fire-box.....	141 sq. ft
Total.....	1,978 sq. ft
Grate area.....	131,000 lbs
Weight in working order.....	116,000 lbs
Weight on driving wheels.....	

The front, back and main tires are flanged and the second pair are plain. They are held by shrinkage and also by retaining rings. The driving boxes are of cast steel with phosphor bronze bearings. The cross-heads are of steel with tin bearing surfaces. The truck wheels are 36 in. in diameter and are of the Vaucrain wrought center steel tired pattern with steel axles having journals 5½x10 in.; the American outside equalized steam brake is used on all driving wheels. The engines are furnished with two Sellers 1887 injectors with the Nathan lubricator, United States metallic packing for piston rods and valve stands and two spring buffers on the front end. The engines are furnished without tenders. The most interesting feature about these two types of locomotives is the arrangement of the fire-box which it is hoped may be presented at a later date.

heavily, kept adding cars to the trains as we thought the engines could pull them, and they did pull them, but the reports showed that we were not getting more tonnage over the road. On analyzing the reason for this it was found that the trains were largely delayed at meeting points and it was decided to reduce the trains. They were quite largely reduced in the number of cars hauled, and the amount of tonnage over the division was very largely increased by doing so. The increase came about from the fact that, while the engines were not hauling as many tons of freight per train, and figuring from the standpoint of engine economy, and from the standard of fuel burned alone, the engines were not showing an economical operation, yet looking at it from the broad standpoint of the amount of tonnage that could be moved over that division with a certain amount of power, we were able to make a much better showing, and a consequent gain in revenue for the company, by reducing the train load instead of increasing it. If the statement is made in the broad sense that the loading of the engines should be increased, and the economy of the service would be benefited thereby, I think we may often fall into error in following out that method.

The paper states: "By keeping the engine in first class condition at all times, I believe every locomotive in freight service on our western roads can be made to earn at least \$4,000 more for the company per year than at present; and the expense will not be increased except for fuel at the average rate of 5 lbs. of coal per car mile." I cannot exactly come to the same conclusion as the writer on that point, and it seems to me that either my figuring is wrong, or that in the paper is rather misleading. It cannot be fairly stated as the paper gives it that the locomotive can earn on this basis \$4,118.40 more for the company than it did before. This would only be true on the assumption that the extra car load of freight which the engine is made to haul would not be hauled at all if this particular engine did not haul it. This is certainly not ordinarily true, and would only be true when the facilities of the company were taxed to their utmost, and it became a question of pulling an extra car or refusing the freight. Even then I cannot see how the earnings of the company would be in-

creased to this amount. The gross revenue would be increased under those conditions, the amount stated, but the net earnings to the company would certainly be the difference between the revenue received and the cost of operation which would have to be deducted. Under normal conditions if this engine, pulling the average train of 20 loads, did not take this extra car, some other engine would, and the result would be to increase the train and locomotive service 1-20, or 5 per cent. The saving, then, that would be effected by the hauling of one extra car, if the average train was 20 loads, would be that effected by reducing the average train and locomotive service 5 per cent. The train and locomotive service expenses on a prominent western road, as shown by its 1894 report, were about 33 per cent of the total operating expenses. Five per cent of this would be 1 1/2 per cent of the total operating expenses; this would amount to \$571 per engine per annum, assuming all train service were reduced 5 per cent. This, of course, would not be the case, as the increased car only effects an economy in the freight train service, and the expense that I have cited, and the revenue accruing from a reduction of 1 1/2 per cent, is a total train expense, both passenger and freight. If the freight train service amounts to two-thirds of the total train service, which it did in this particular case, the saving would be reduced in the same proportion, or to \$380 per year. This, of course, is a good gain, and well worth striving for, but it is only to be attained if the average train can be increased one car. The increase of an average train one car does not depend wholly, or even principally, upon the ability of the engine to haul more tonnage, but, I take it, more largely on the condition of the traffic and the practicability of loading all trains heavily at all times. It is, therefore, very questionably whether a large increase in cost of repairs will produce the results claimed. I mean by that, that even if the results cited could be effected by an increase of the average train one car, it seems to me not so much a question of the engine's ability to haul that extra car as the ability of the operating department to give it the extra car on the average all through the year. The fluctuation of business makes it necessary to run the trains even much lighter than the capacity of the engines a large portion of the time, so that the saving effected by hauling the extra car when there is traffic enough to do so, would be even much less than the figures I have just given.

Mr. J. N. Barr (C. M. & St. P. Ry.)—If we would suppose that hauling an extra car increased the revenue \$4,000 I apprehend, then, that under ordinary circumstances, the \$4,000 would be the earnings for each car, and this certainly should be the position if we are going to strike an accurate average. Now, figuring on that basis, the earnings of the St. Paul road last year would have been something over \$100,000,000, so that the illustration has got to be limited very decidedly, before we can allow the matter to pass. On the St. Paul road the capacity of the engine is about 25 per cent greater than the average load. We get trains that give a full load, but take it over the entire system, take it on the busy divisions, the very busiest division, the average loading is about about 25 per cent less than the capacity of the locomotive. Now until the transportation department is able to wipe out that 25 per cent the extra car which might occasionally be hauled does not cut such a great figure, and it seems to me that it is almost impossible to figure what force should be attributed to the claim. I have always found in the things that I have been specially familiar with that the happy medium was the best course. I do not believe in these locomotives with 22,000 and 23,000 lbs. to the drivers. I do not believe in locomotives with 15,000 lbs. to the drivers. They are both extremes, out of date; no, they are not both out of date to-day, I think, but it would be better for the railroad companies if they were. I am satisfied on that point, and the railroad companies that will adopt the happy medium between those two extremes in the weight of locomotives, in loading locomotives, in the size of rail, and in almost every other point are, I believe, the railways that will be held up as examples of good net income and good management.

Mr. G. W. Rhodes (C. B. & Q.)—I am a little afraid some of us will try and get a grain of comfort out of the paper which is not intended, and which might not be wise for us to do. Some years ago I was connected with another road and there was so much unpleasantness over the dollars and cents shown on the performance sheet that it was finally decided to abandon this feature of the sheet; and in my connection with the C. B. & Q. R. R., I have felt at times a good deal like wishing we had no performance sheet, for similar reasons. I do not know whether odious comparisons of performance sheets have extended to the Union Pacific or not, but I think we ought to consider a little what the performance sheet is gotten up for. Now I take it that the performance sheet is for useful purposes, and when used as intended by the mechanical department, it serves a good purpose; but unfortunately other departments will get hold of the performance sheet and use it in a way that is not intended. For instance, they will take the C. B. & Q. sheet and compare it with the Milwaukee sheet. The conditions are different. But I would not advise any one to pay too little attention to the performance sheet. The performance sheet is gotten out to compare with yourselves. It is gotten out to compare your own work, month by month and year by year. Keep your performance sheet for its legitimate use. It is a very good thing to have and the more you study it and the more you watch it, the better service you will be performing for your railroad.

Mr. McConnell makes this statement: "When we consider the service of the locomotive from the standpoint of what it can earn, and not what it costs per mile to run it, we will then begin to increase the number of freight cars per train," and so forth. Now I agree with Mr. McConnell thoroughly in this, but strike out the two words "per mile," and I do not agree with him at all.

Mr. A. E. Manchester, (C. M. & St. P. Ry.)—On page 218 of our December proceedings there is the following: "The question should only be considered from one standpoint, that is how much we can make the engine earn. To accomplish this, that is, make it earn all it can, the idea must be given up that an engine should run from 75,000 to 100,000 miles before it is taken into the shop. When freight engines are kept in service until they have made that mileage, the company is not getting the revenue the engines could earn. An engine in freight service should

haul every ton of freight it is capable of doing, regardless of cost for repairs and fuel."

If Mr. McConnell means by this that whenever an engine ceases to show its best work or becomes expensive in the performance of maximum service it should be taken into the shop, then I agree with him fully; but I would not have any scheduled time for taking the engine into the shop; neither would I have any fixed number of miles that an engine shall have run that shall take it to the shop. If an engine is not performing maximum service before it has made 10,000 miles, or is costing an undue amount to operate, I think that engine should be taken to the shop, or such alterations made as will put it in first class serviceable condition. I would also say that if an engine has made 100,000 miles, and is still capable of performing first class service or maximum service for that class of engine, I can see no reason for shopping it.

Mr. S. P. Bush (Penna. Lines)—I think Mr. McConnell's idea of the saving effected is wrong, and that the proposition would be more fairly put in this way: "Given a certain amount of freight to haul, a certain number of tons or a certain number of cars in a given time, what is the cheapest way of hauling it, so far as the loading of the engines is concerned?" Of course, Mr. McConnell's idea is that the engine miles employed in moving that freight should be in number so that they can just haul the amount in the required time. Now the factor of speed is a very important one, but if you put the proposition as I have stated, I think it will present itself in a little different light. It would be a mistake to haul that freight any faster than is required, for the reason that the cost of labor would not be reduced. The labor cost would be the same in running 100 miles, whether made in five hours or seven, but the saving that could be effected by the railroad company I think would come in this way: If you should be able to handle the freight with 10,000 train miles in the time required under the practice that exists today on some railroads, it might be reduced to 9,000 train miles. The saving that would be effected would be represented not exactly but largely by the reduced number of train miles.

Mr. C. H. Quereau (B. & M. R. R. in Nebraska): The usual custom, the country over, is to say that an engine has cost so much per engine mile run. This really means nothing. It can be shown that the heavier the load of the engine within the reasonable limits, the less will be the cost per ton mile, which is the correct basis of comparison. There is a movement in that direction, I know. There are one or two roads which have considered the matter very carefully, and if the operating departments, could see it in the same light that the motive power men do, that would be the basis they would use; so that in some cases at least the motive power department is not responsible for the present basis of comparison. But I do think that the basis of comparison should be the ton mile, rather than the engine mile, and that it should receive very careful consideration.

Mr. Wm. Forsyth (C. B. & Q. Ry.):—I should like to see if the club, now we have this subject before us, cannot do something in the way of reforming the method of rating locomotive performance, and especially in coal consumption. I know, that the question has been agitated often before, but now, since so large a number of roads are beginning to rate their engines on a tonnage basis, I believe it is possible to obtain the necessary figures so as to use the unit of pounds of coal per ton mile in the performance sheets, and thus make them comparative to some extent, at least to much greater extent than at present, between different roads. As long as these performance sheets are exchanged between different roads, we ought certainly to try to do something to make them more useful, and the idea I had in mind was this; that I would offer a resolution instructing the secretary to send a memorial to the Master Mechanics' Association, urging them at the next convention to adopt as a standard the unit of pounds of coal per ton mile, or per 100 ton miles, for locomotive performance sheets. I offer that as a motion. [The motion was afterward extended to include repairs per ton mile and carried. Ep.]

Mr. J. H. McConnell (Union Pacific):—We have on the Union Pacific Railroad grades ranging from 26 ft. to 93 ft. to the mile. For the first 516 miles of the road the grade averages about 10 ft. to the mile. There is a rise of 5,000 ft. in 516 miles. From Cheyenne to Sherman, a distance of 32 miles, there is a rise of 2,200 ft. On the other side, going down to Laramie, the maximum grade is 93 ft. to the mile, and for 449 miles from Cheyenne to Wasatch there is not a point on the line where the altitude is below 6,000 ft., and it runs from 6,000 ft. up to 8,247 ft.

Five years ago when we commenced increasing our train haul or increased the service of our locomotives, we found the train haul for the year 1890 averaged 15.86 cars. In 1891 we had increased it to 16.11 cars; in 1892 to 16.85 cars; in 1893 to 17.12 cars; in 1894 to 18.96 cars, and for the year 1895 it will average about 21.88 cars to the train, for the same engines.

In 1890 the cost of hauling a loaded car one mile, that is including all the expense of the locomotive and car departments, was 3.17 cents over the entire system. In 1891 it cost us 3.05 cents; in 1892, 2.84 cents; in 1893, 2.79 cents; in 1894, 2.65 cents; and in the month of October, 1895, it costs us 2.01 cents to haul a loaded car one mile.

Showing the result of a systematic effort in the train haul on the Wyoming division last year we will take one month. In the month of September, for instance, we handled 80,558 cars in 1894 and 79,942 in 1895. There was a decrease of 616 cars handled on that division, a mountain division. Our train miles in 1895 decreased 44,000 miles, and we ran 484 less trains and handled only 616 cars less. The number of cars to the train hauled on the Wyoming division in September, 1895, was 27.95 cars, and September, 1894, it was 22.50 cars. That was an increase of nearly 5 1/2 cars per train, with the same engines. We did that by putting helpers at different points along the line of road where we could help the trains over the hill. Where we were pulling 25 to 30 loads with one engine by the assistance of a helper on some of the grades the train haul was increased in a number of instances to 45 loads. In 1894 we ran 89,509 trains; in 1895 we ran 82,056, a decrease of 7,453 trains. The freight train mileage was 7,155,000 miles in 1895, and 7,742,000 miles in 1894, a decrease of about 586,000 miles. The car mileage in 1895 was 190,287,-

000 miles, and in 1894 was 196,939,000 miles, a decrease of 6,000,000 car miles in 1895. While our engine mileage in 1894 was 10,108,000 miles, in 1895 it was 8,760,000 miles. There was a decrease of 3.3 per cent in our car mileage, a decrease of 7.4 per cent in our train mileage, a decrease of 8.3 per cent in the number of trains run, and a decrease of 13 per cent in the engine mileage.

On the Nebraska division (which we call a level division, because it has a rise of only 5,000 feet in 516 miles) in 1895 the average earnings of the freight engines was \$70,676, and they averaged 25.89 cars to a train. It cost us to operate each locomotive in freight service \$9,369, leaving the net earnings of each and every locomotive on the Nebraska division \$61,307.

On the Wyoming division, where we have to run helpers, we have figured the helpers in with the freight engines, and each engine there earned \$53,918.09, with a cost of \$11,357 for operation, leaving the net earnings of each engine there \$42,560.

In 1894 it cost the Union Pacific Co. \$1,040,000 less to haul their freight cars than it did, comparing the same number, in 1890—all due to the increased service from the locomotives, and to no other cause.

The cost per mile for locomotive performance for the last six years was: In 1890, 26.45 cents; 1891, 26.16; 1892, 25.96 cents; 1893, 26.19 cents; 1894, 27.48 cents; 1895, 25.03 cents.

It seems to me the problem is not to figure on how much it costs to operate engines, but to figure on what they can earn. And I believe it would be an excellent thing if all the railroads in this country would adopt a uniform system of making up their locomotive accounts, the same as has been suggested here. If it is done in that way one road can compare with another, and we can all then find out what our neighbors are doing.

FINE WRITING.

In the RAILWAY REVIEW of October 19, 1895 was published the following item:

FINE WRITING.—To illustrate the wonders of human skill Prof. Henry Morton mentions an engraving of the Lord's prayer, in the Army Museum at Washington, on a piece of glass covering less than one-thousandth part of an inch square, the whole surface being invisible unless as a speck. He computes that on the same scale the whole of the bible containing 3,556,480 letters could be engraved in a space equal to one-eighth of an inch in area, or that the contents of the bible could be engraved eight times on one inch square. This is inconceivable, presents itself to the mind when compared with observable facts as an illusion beyond the realms of fancy even. An exchange wrote to Prof. Morton to inquire how such minute work could be done, and quotes the following from his answer: "The exact method followed in the microscopic writing made by Webb of England is, as far as I know, a secret, but without doubt it is accomplished by a machine on the principle of the 'pantagraph,' the secret mainly lying in the method employed to take up 'lost motion' between the parts."

The item was reprinted by Public Opinion and elicited the following communication, which was by that journal referred to us.

NO. 5 STREATLEY ROAD, BRONDESBUURY,
LONDON, N. W., ENG., Jan. 22, 1896.

Editor of Public Opinion:

DEAR SIR—Allow me to call your attention to an article in Public Opinion, January 9, 1896, page 63, "Railway Review," and to ask if in your opinion it is altogether correct if the space occupied by the Lord's prayer—227 letters—be less than one thousandth part of an inch square, then $1,000 \times 1,000 = 1,000,000$, so that there would be space on one square inch for 1,000,000 times 227 letters, or for 227,000,000; which divided by 3,556,480 would show that on one square inch there would be space enough for more than 63 bibles— $\left(\frac{63 \times 2,941,760}{3,556,480}\right)$ —If the Lord's prayer occupies

about one-thousandth part of a square inch, then on one square inch 1,000 times 227 letters might be placed or 227,000; but as the bible is stated to have 3,556,480 letters, dividing 227,000 by 3,556,480 gives .063+ or a little more than 1-16 of one bible.

The statement, that the writing on the glass mentioned is on a scale that would allow eight bibles to be put on one square inch, is no doubt correct. In 1876 there was exhibited at Philadelphia a photo-micrograph, by Brev. Brig. Gen. J. J. Woodward, of writing on glass made with a diamond by the late W. Webb, Esq. The photo-micrograph proved that more than eight bibles could, if written on the same scale, be put on one square inch. I have heard of Webb's writing on the scale of 15, and of 50 bibles to a square inch, but not so fine as 63.

Yours very respectfully,
S. W. FLETCHER.

The correspondence was on receipt referred to the officer in charge of museum in question with the following result:

WAR DEPARTMENT, SURGEON GENERAL'S OFFICE,
U. S. ARMY MEDICAL MUSEUM AND LIBRARY,
WASHINGTON, D. C., Feb. 17, 1896.

Editor Railway Review:

DEAR SIR—In answer to your inquiry of the 15th inst., I would state that there is in this museum a slide containing the Lord's prayer, 227 letters, in a space 1-294 of an inch by 1-441 of an inch, or in the 1-129,654 part of a square inch. This would be at the rate of 29,431,458 letters to the square inch. As the bible is said to contain 3,556,480 letters, its contents could be engraved more than eight times on one square inch.

The photo-micrograph exhibited in Philadelphia, in 1867, by the late Surgeon J. J. Woodward, U. S. Army, was made from the slide now in this museum. Your enclosures are herewith returned.

Yours respectfully,
D. L. HUNTINGTON,
Deputy Surgeon General, U. S. Army, in charge of Museum and Library Division.

How to Distinguish Between the Different Kinds of Iron and Steel.

It will not be difficult for an expert to make a distinction between the different kinds of iron and steel, for flexibility, the ability to be welded, the appearance of the fracture and other features furnish mostly a reliable basis for passing judgment. A simpler means of distinction is found in the use of acids, by means of which the respective metal is cauterized. According to the nature of the latter, that is the chemical composition and structure, towards which the acid acts in a different manner, the cauterized places have a certain appearance both in regard to color (from white to black) and the structure of the metal now shown more plainly which is especially expressed in the so-called figures of corrosion now appearing. In a general way a distinction between iron and steel can be made by putting a drop of greatly diluted nitric acid upon the smooth surface of the metal to be tested and rinsing it off with water after a few minutes without wiping. The spot thus cauterized appears deep black if the metal is steel on account of the carbon being separated from it; iron shows a grayish white spot, this being the color of the pure metal.

The following is a good method to distinguish between the different kinds of iron and steel. The corrosive used is muriatic acid of 1.062 spec. gravity. The metal to be tested is first as smoothly polished as possible, whereupon it is immersed in the corrosive liquid. When the cauterizing has plainly materialized, the metal is rinsed with water and brushed, and finally washed with dilute spirits of sal ammoniac and then dried. In order to preserve the metal for reference, which is especially recommendable, if it shall be compared with metal to be tested later, it is coated with transparent gum-lac, which prevents it from rusting.

In regard to the appearance of the cauterized places, Professor Kick, of Prague, has made the following observations with the different kinds of iron and steel.

Soft or Fibrous Forge Iron. If it is of excellent quality, it will be attacked uniformly, even if the action of the acid has lasted for several hours; defective places and ash holes make their appearance. The cauterized surface appears bright and of weak lustre. "Fine grain" iron. The conduct is similar to that above. The cauterized surface appears still more uniform, but darker.

"Coarse grain" or cold short iron is attacked more sharply than the kinds mentioned before. The surface becomes black very soon on account of the strong separation of carbon; after the acid has acted about $\frac{1}{2}$ hour the coal can be washed off as a black slime; the exposed surface remains black even. The surface is uneven and corroded, which can be observed plainly, when the metal is dried after about one hour's cauterizing and the file is applied slightly to the cauterized surface.

Tempered iron and malleable cast iron. These kinds are attacked as a rule very strongly by the acid. The cauterized surface appears unevenly corroded, showing fissures and cracks.

Puddle Steel.—The color of the cauterized surface is a rather uniform gray.

Bessemer and cast steel are attacked quite uniformly; defective places are found but rarely, and these do not show off to any great extent. The color is gray and increases in brightness with increasing softness of the steel. Fine fissures become visible after cauterizing.

Pig iron, cast iron and gray pig iron conduct themselves similar to steel; the color of the cauterized surface is a uniform dark gray.

White and Underdone Iron.—The white parts show off plainly upon the cauterized surface, dark spots of gray iron being interspersed with them. If in an iron article different kinds of iron are mixed, the components being related more closely to the acid are dissolved predominately by cauterizing, while the others are but little attacked by it.—American Manufacturer.

STEEL CENTER SILLS FOR BOX CARS—C., B. & O. R. R.

In the RAILWAY REVIEW of February 16, 1895, an illustrated description was given of the application of steel center sills to locomotive tenders and the idea first carried out on tenders has been arranged for application to the underframe of a new 60,000 lb. capacity box-car for the purpose of experimenting in order to determine the value of steel sills in car construction. In the accompanying illustrations, Fig. 1, shows a section through the framing of the end of the car with the floor removed and also a sectional view taken parallel to the sills and between the deadwoods, showing the method of attachment of the steel center sills to the end sill. 1 $\frac{1}{2}$ -inch iron plate bolted to the inside face of the end sill, is made in such a shape as to project downward opposite the ends of the 10-inch channels of which the sills are

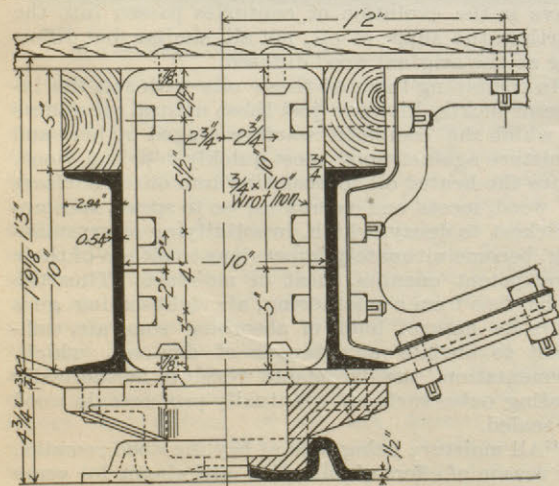


FIG. 2.—SECTION AT BOLSTER.

composed. Angle pieces are riveted to these plates and to the webs of the channels as shown in the illustrations. Upon the top of each center sill, a filling strip $3\frac{1}{2} \times 5$ in. in section is placed which runs the entire length of the center sills in the same manner as that employed in the new standard box-car of this road, illustrated in the RAILWAY REVIEW of January 25, page 49, current volume. Reference to Fig. 1 will show the method of attachment of the draft gear to the center sills to be similar to that employed with the wooden sills, the sills themselves being used as draft timbers and the end sills carry the dead blocks in the proper position to resist the stresses thereon to the best effect.

The arrangement of the center sills in connection with the body bolsters is similar to that employed in the design for the tenders referred to, in that the steel channels rest upon the lower member of the

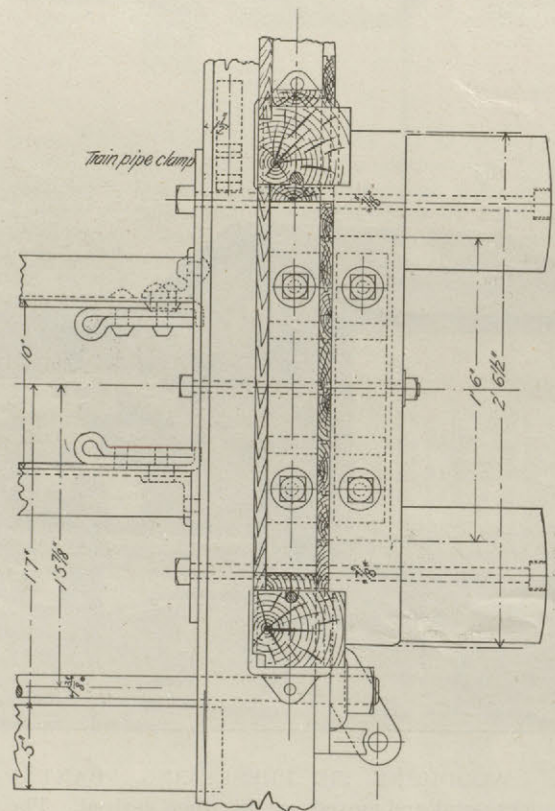
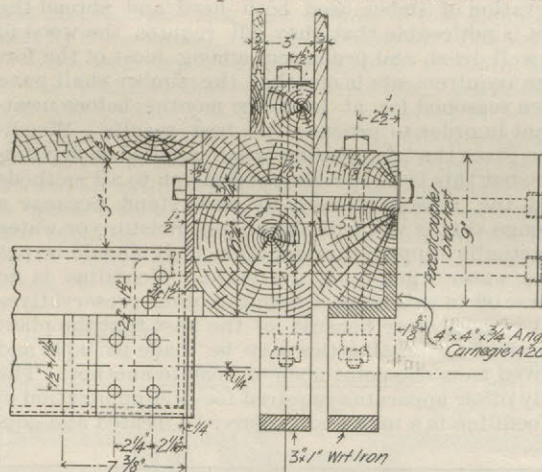


FIG. 1.—ATTACHMENT CENTER TO END SILLS.

truss forming the bolster and the channels are held at the proper distance apart by means of a wrought iron box of $\frac{1}{2} \times 10$ in. material to which the channels are bolted through their webs. This box is of the same width as the wrought iron members of the bolster and serves also to secure the filling pieces in place which rest upon the center sills. The center plates are riveted to the lower members of the bolsters and the security of the fastening of the center sills and the bolsters is at once apparent upon examining the drawings. It should be stated that in all of the fastenings and attachments to the steel center sills no holes have been drilled through the flanges of the channels. While the whole of the

body bolster is not shown in Fig. 2, comparison of this illustration with Fig. 5, page 49, of the issue of January 25, will enable a good idea of its construction to be obtained.

In Fig. 3 is shown a cross section of one-half the floor system of the car, taken between the needle beams and also a section parallel to the center sills showing one of the needle beams in section. These two illustrations show the method of attachment of the center sills to the needle beams in which bolting through the flanges of the channels is avoided. The attachment is made by means of a U-shaped strap of $\frac{1}{2} \times 3$ in. iron to which the needle beam is bolted at the bottom and the filling blocks are bolted at the top and the channels are riveted. This illustration shows the 4x6 white oak filling block resting upon the needle beam and extending from the center to the side sills. It also shows the 2 in. oak intermediate sills which are placed opposite the doors to stiffen the floor at these points. The large intermediate sills are placed comparatively near to the center sills in order to assist in the resistance of buffing stresses. The attachments for the support of the brake rigging, brake cylinders and the necessary hangers are secured to the center sills and also to the filling blocks above them by U-shaped straps similar to that shown in Fig. 3.

So far as is known this is the first application of steel shapes as sills in car construction, and, while it must be considered in the nature of an experiment in this case, or, in other words, it has not been adopted as standard, there seems to be excellent reasons for predicting satisfactory results with the plan. The increase in weight due to the use of steel is not excessive, although we are not able to state the exact amount added. The strength of the frame must necessarily be increased, and the advantages of the continuous feature of the draft gear is attached directly to the center sills is another point in favor of this construction. In fact, unless some unexpected fault develop in service, there seems to be no reason for anticipating anything but success in the use of this arrangement.

HIGHT OF FREIGHT CARS.

JERRY SULLIVAN.

During the month of January the Denver & Rio Grande Railway had a large number of box cars constructed by the Madison Car Co. They have a capacity of 60,000 lbs. and have a neat and substantial appearance. The chief interest in them to a trackman, however, lies in the fact that they are set about 14 in. lower than the ordinary car and to this extent overcomes top heaviness and the destructive effects on roadbed incident thereto. The upper portion of the wheels are hidden between the sills thus bringing the floor of the car within a distance of about $3\frac{1}{2}$ ft. of the rail.

Heretofore the car builders have apparently vied with each other in their efforts to get the car up in the air as high as possible and with the rapid increase of speed of freight trains in late years the difficulty of maintaining good track has grown out of all proportion to the number of trains run, and it is evident that the undue elevation of freight cars has had much to do in bring about such results. Passenger cars are open to the same objections, but while their height seems to be beyond all reasonable necessity their great length in a measure prevents the car swinging from side to side with every little irregularity in the roadbed. Consequently the line of the rails is not disturbed to the same extent by passenger coaches as it is by the shorter but more erratic freight cars. With the era of 60,000 lb. cars the weight per axle is nearly the same on passenger and freight cars, and the effect on track almost equal—that is the effect of greater speed of passenger trains causes no more damage to the track than arises from the jolting and swinging of the lower freight trains, when top heavy cars work especial injury to the line of the track. The new cars mentioned are built in much the same style as narrow gauge cars whose low load line permit them to run safely with incredible speed over mountain roads when line and surface often receive but scant attention. It would be safe to say that if the narrow gauge

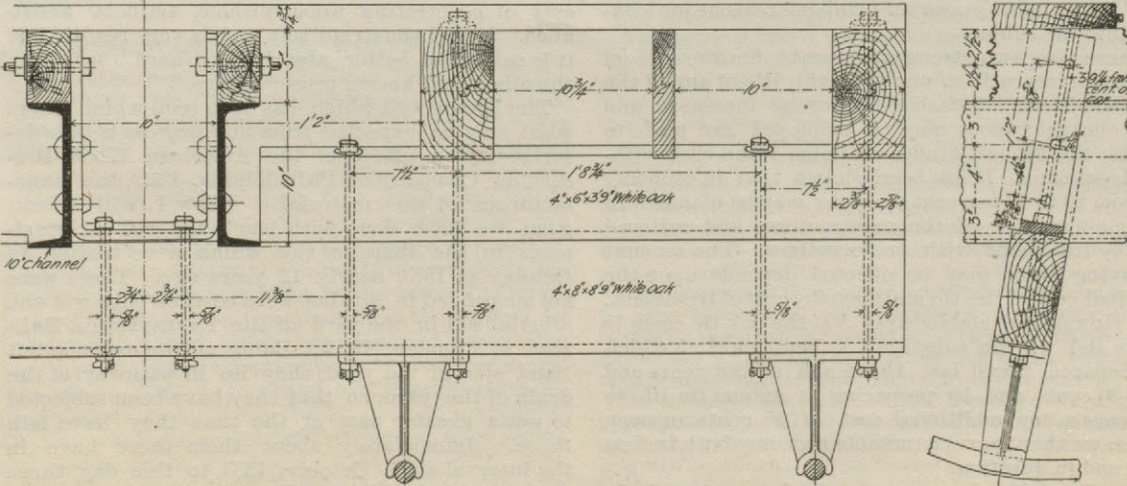


FIG. 3.—SECTION SHOWING ATTACHMENT TO NEEDLE BEAM.

cars on western roads were elevated in the same proportion as some of the standard gage cars the number of accidents resulting would cause the words "net earnings" to disappear entirely from the annual reports of such lines.

If then such cars can be operated with more freedom from derailment on very rough narrow gage track, is it not reasonable to suppose that cars constructed after the same plan would show like results on standard gage roads and if freedom from derailment means anything does it not indicate a sort of harmony between the moving car and the rails to be found only when low decked cars are used. Of course, the height of draw-bar as established by M. C. B. standards prevents the floor of freight cars being lowered beyond certain limits but those interested in maintenance of track will be satisfied if the car is swung as low as possible without interfering with the prescribed height of the draw-bar. Such cars are in use to a limited extent on several standard gage roads and it is to be hoped that they may become the standard of the future when rivalry will become so keen as to force traffic managers to double the present speed of freights as one of the resources of competition.

Everything seems to indicate that the day of fast freights is not far off and it behooves those interested in track to see that improvements made in rolling stock for that purpose are improvements in fact and not destructive to the roadbed. To a trackman the improvement in late years appears to consist mainly of putting more daylight under the cars until the height of folly seems to have been reached in cars built for the California fruit trade. A single car of this type will do more damage to track than a whole passenger train. If any one cares to test the truth of this let them carry for instance a 100 lb. sack of flour on their shoulder say 200 yards then fasten the load to a pole and raise it nearly two feet above their shoulders and try to carry it back again. The difference will be appreciated at once and the difficulty of carrying a wobbly load will be fully understood. It should be stated that the roof of the Denver & Rio Grande cars mentioned are equal in height to the ordinary freight car but as the upper half of the average loaded box car generally consists of wind and as wind confined does no damage to track the height of the roof occasions no complaint on the part of trackmen; but all agree that the floor should be lowered as much as possible in the interest of good track.

WOODLINE FOR TIMBER PRESERVATION.

It has been said that "the tie is the life of a railroad bed. A good tie means a good track and a good track means good rolling stock with lessened repairs." The metal tie may be the tie of the future but owing to the high cost of this form the economical use of the wooden ties in the present type of track is of more immediate interest, and this because of the gradually increasing cost of timber, owing to the destruction of the forests. The question which interests railway managers in this connection is how, by the expenditure of a moderate amount upon each tie, to increase its life of usefulness. The question as to whether it pays to preserve ties against decay has been very positively answered in the affirmative by European engineers, and they now look upon a process of preservation treatment as a matter of course. It has been estimated that in 1878 out of 60,000,000 ties on the German railroads 25,000,000 were impregnated, and that even with the extraordinary length of life stated for unprepared ties—about 14 years for oak and 6 for fir and pine—there would have been a resulting economy of \$1,000,000 per year or about 33 per cent on the cost of renewals if the remaining 35,000,000 ties had been treated. This estimate was made by Privy Councillor Funk, and is published in a recent bulletin issued by the forestry division of the United States department of agriculture. There are reasons involving finance and uncertainties with regard to the amount of confidence which should be placed in the methods of treatment of timber, which have caused railway managers to hesitate about spending money in this way but the information which is here presented with regard to the use and value of "woodline" as a timber preserver furnishes reasons for looking into the subject.

There are two strong arguments for the use of timber preservatives, viz: that the life of any of the common forms of timber is thereby increased, and that cheaper woods may be employed and made to outlast the highest grades of timber when used without treatment. It has been shown that an economy of from 20 to 50 per cent per year may be obtained in the maintenance of timber structures and railroad ties by treatment with preservatives. The amount of saving which may be effected depends upon the original cost of the tie and upon the cost of treatment. Mr. Howard Constable says: "If the oak tie costs 75 cents and we can substitute a hemlock tie, which unprepared would last three and a half years and cost 30 cents, and by preparing it extend its life to 12 years at an additional cost of 25 cents or even more, we then have a notable economy both in first cost and in duration."

Mr. Constable also speaks well of several methods used in foreign countries and says that we should

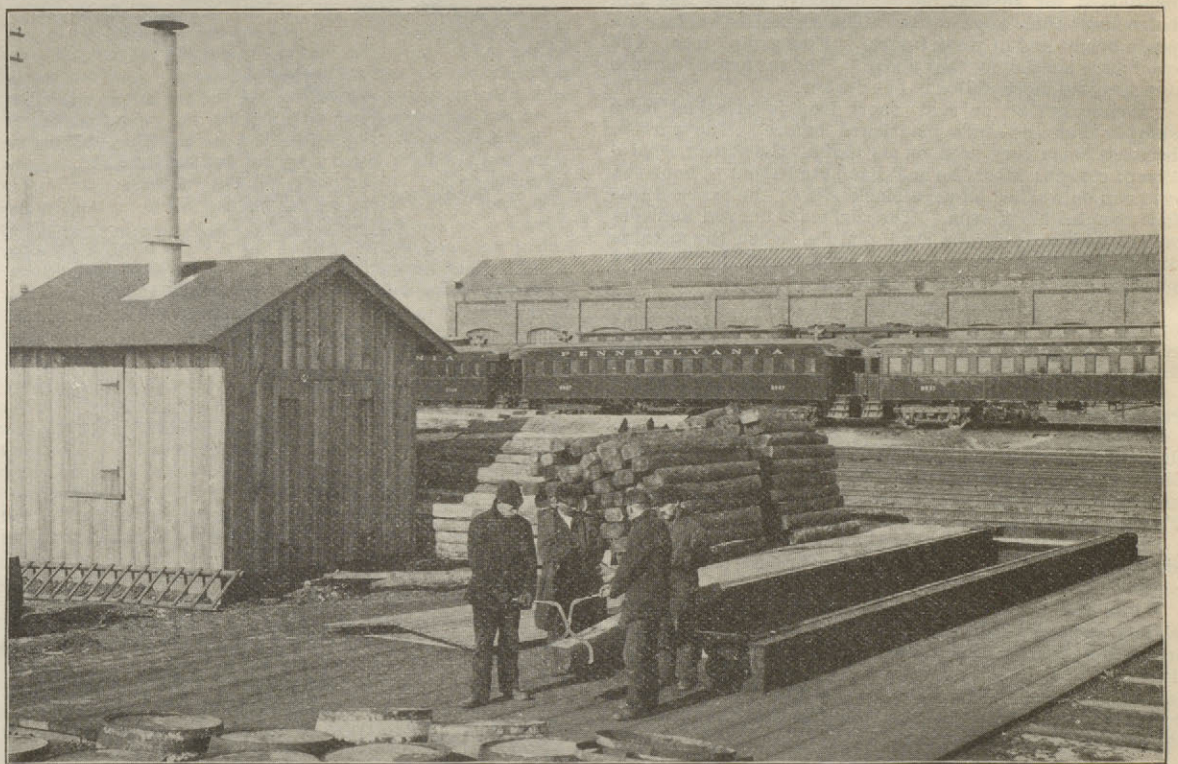
look for cheaper methods in this country. Among the conditions of success stated by him are the following: "For railroad ties it will be advisable to select the harder kinds of wood to guard them against cutting into by the rails, especially upon curves. Preservation, however, materially adds to the natural hardness of timber, and it is found to resist cutting by the rail under ordinary traffic, from 12 to 16 years."

"Extract the sap and water, as far as practicable, before injecting the preservative. It is obvious that a liquid solution cannot be forced in unless there is a place for it, and yet most of the failures of valuable methods can be traced to neglect of this obvious requirement. Timber must be well seasoned, either naturally or artificially before the antiseptic is injected."

In all of the descriptions of the processes for preservation of timber used both here and abroad the fact is noticeable that they all require the wood to be well dried, and prominent among most of the foreign requirements is one that the timber shall have been seasoned for at least six months before treatment in order to procure the best results. Woodline gives the best results when applied to dry timber, but this is a requirement common to all methods and the reason is easy to understand because a sponge that is wet will absorb less moisture or water if actually dipped therein, than if it should be put into water when in a dry state. Woodline is no worse off in this respect than the other preservatives but rather better because of the fact that the plant required for heating ties may be made portable and moved from one point upon a road to another. The only other apparatus required for the application of Woodline is a tank and this may be located at a con-

words, the Woodline, has prolonged the life of these black oak ties (already) to three or four times that of best white oak in this spot at Camden. They are there now, and show no sign of going to pieces."

The best record for first-class white oak ties used in this place was from six to eight years of service. The most remarkable part of the long service of the treated ties mentioned was that they received the woodline from a brush from a pot of the heated liquid. This facility of application will, it is thought, prove to be one of the best recommendations which any such material can possibly have. It was the result of the experiments in the Camden yards and also on the Amboy division near Beverly, N. J., which led to the decision of the officials of the Pennsylvania Railroad to adopt the method for all of the timber preservation which is carried on by the road and this is an excellent indication of the merit of the process. In the accompanying illustration the operation of tie treatment as it is carried on by the Pennsylvania Railroad at Pavonia, N. J., is clearly indicated. The ties are treated in bundles of six, one of which is placed by the attendants, in one end of the tank containing the woodline and after being allowed to remain in the bath for from five to ten minutes the ties are removed and others placed in the solution. The tank is 35 ft. long, 5 ft. wide and 6 ft. deep and is built with its top slightly raised above the level of the platform surrounding it. A steam pipe is coiled about the inside of the tank and steam is furnished from the boiler located in the small building in the background. This boiler also furnishes steam for handling the ties, but the illustration shows the operation of discharging the tank as performed by hand. It has been found that better results have been secured by heating the



WOODLINE TIE PRESERVING PLANT PAVONIA, N. J., PENNSYLVANIA RAILROAD.

venient point and moved easily when desired. The absence of expensive and cumbersome apparatus is one of the strong features of this process, and this will have great weight in consideration of its adoption by railway officers. The compressing pumps and pressure cylinders used in several of the other processes are dispensed with and the facility with which this preservative will penetrate soft or hard woods is another of its strong claims for consideration. It has been successfully applied with a brush as if it were paint, and when used in this crude manner very satisfactory results have been obtained with it in practice. The material itself is not as expensive as other kinds of preservatives and from figures which have been published this method seems to be one of the cheapest if not the cheapest in use. The greatest advantage possessed by it is the property of penetrating wood without artificial assistance. It will penetrate soft woods very readily and it is said to be better absorbed by hard woods than the other well known preservatives.

The best record which has been seen which shows what may be expected from this process is thus described by an officer of the American Wood Preserving Company of Philadelphia, Pa., the manufacturers of this material. "Now I will submit what we have done with black and red oak specimens in the shape of ties which were treated in October of 1883, nearly 12 years ago. These were not suspended in air, but were covered with wet and alluvial soil in the yard of the Pennsylvania Railroad at Camden, N. J. Being at the extreme left hand side of the yard, they lie in pathway of the drain of the yard, so that they have been subjected to wet a greater part of the time they have lain there. Immediately about them there have in the interval since October, 1883, to this day three or four sets of the best white oak ties taken up, and their places filled with other sound ones. In other

ties and placing them while hot in the tank of cold solution.

A hard oak tie will absorb about two quarts of the preservative and the cost is said to be about 15 cents per tie. This however may be reduced to about 12 cents through some contemplated improvements which the road is soon to put into effect. The cost of transportation of ties is low and the simplicity of the plant renders it portable for movement to the location wherever it may be used to the best advantage. It has been suggested that the tank might easily be mounted upon a flat car for the sake of reducing the cost of moving it about.

The operation of the preservative is described by an officer of the company as follows: "We have made use of compounds which, centuries ago, were the elements of wood itself; but, being indestructible, have in the evolution of centuries passed into the earth in the shape of oil, not all similar, but differing as the original wood differed.

In combining three of these oils with salt the inventor luckily hit upon just those natural substances of which the combined warfare waged by heat and moisture against wood most quickly deprives wood. Thus the heated oil, percolating into outer surfaces of wood, meets and recreates, so to speak, substances to decay, which, in solidifying or crystallizing, become ultimately impervious to either of their most potent enemies, heat or moisture. Thus the wood, free from a smothering, air tight-sealing, goes on in its natural habit of absorbing some air, sufficient to obviate any danger of dry rot, which, fermentation, the inevitable result of hermetically sealing outer surfaces, eventually produces in wood so sealed.

"All moisture being held at bay, the wood remains, by reason of effect of oils, live and elastic for years and years beyond its normal existence. It is a fact to which we point with especial satisfaction that none

of the specimen ties from which we gather our strongest claims, after a period of 12 years' immersion in earth show any material evidence of rot. It is true a slight filamentous tissue of decay is perceptible under the tie, where it rests upon the earth, but scraping this off with a knife, the wood is found hard and sound, in fact harder to the knife or steel than freshly hewn wood of the same species. Herein lies the proof of crystallization. It is reasonable to conclude that of all good testimony the most valuable concerning the merits of a wood preserver must be deduced from the evidence of treated wood itself, extending over a number of years, far in excess to the known maximum period of wood of similar species' existence." These tests have already been mentioned.

AN AIR LIFT WATER WORKS SYSTEM.

During the season of 1893 the Ocean Grove Association of Ocean Grove, N. J., built a large auditorium capable of seating 10,000 people. Other attractions were added to the famous summer resort that tended to draw a much larger population than before. A serious problem confronted the managers in the shape of an inadequate water supply, the system then employed being driven wells and deep well pumps. A committee was therefore appointed to investigate the best methods of obtaining a supply of water to provide for 50,000 people and a constantly growing

cylinder, B, to the air receiver, C, and thence to the Pohle pump placed in the well, D, and which lifts the water to the cistern, E. The pump cylinder, F, takes its supply from the bottom of the cistern and delivers it into the tank G, from which it enters the distributing mains. The plant will thus be seen to consist of a combination of two systems—by means of compressed air the water is first raised to a cistern at the surface, and from thence it is raised by a steam pump to the distributing tank. The plant has been found economical and reliable in every respect. No trouble whatever has been experienced in obtaining all the water required. We are indebted to the Iron Age for this illustration and information.

Another application of compressed air, this time to a municipal pumping plant is shown in Fig. 2, which was taken from a photograph of a compressing plant which has just been put in service at Bloomington, Ill., in connection with a series of four Pohle air lifts by the company already referred to. The water is taken from four tubular wells 145 ft. in depth, and it was estimated that with 50 revolutions per minute 4,500,000 gallons would be pumped every 24 hours. The compressor is duplex of the "Ingersoll-Sergeant Corliss piston inlet" type with steam cylinders 16x36 in. and air cylinders 16x36 in. The compressed air is taken from a duct which leads to the outside of the building. The two air cylinders compress 16.8 cu. ft. of free air per revolution or at 50 revolutions about 840 cu. ft. of free air per minute. The com-

pressed; the rate on wheat in carloads from Walla Walla to Portland should not exceed 19½ cents per hundred pounds, or \$3.90 per ton, and the rate for the somewhat longer distance from Dayton to Portland should not exceed 20 cents per hundred pounds, or \$4.00 per ton. Complainant's claim for money reparation denied.

STRAINS OF SHIPS.

The study of stresses and strains which are set up in a vessel in a sea way and under various conditions of loading has been given considerable attention among naval architects abroad. The fact that on some steamers there has been a continuous series of mishaps to the machinery such as the breaking of shafts and of appurtenances, the cracking of frames and bed plates, has called special attention to it. An interesting contribution to the literature on this subject is a paper by Mr. John McCallum, before the Institute of Marine Engineers of England, in which some experiments are described which were carried out for the purpose of determining the deflections of the shafts and entire hulls of vessels in sea ways. A case is described in which a wire was stretched through the shaft tunnel immediately over the shaft and attached at one end to the engine room bulkhead and to the other end a weight was hung after passing the wire over a 6 in. pulley. The weight, 46 lbs., was sufficient to keep the wire taut, and the distance between the wire and the shaft was measured by a scale carrying a roller upon its lower end. This vessel was about three thousand tons net register, and was engaged in the coal trade carrying also a general cargo. She was well built and of a superior class with triple expansion engines which were well balanced. The work was done by first class builders and in spite of this fact the propeller shaft broke on the second voyage and four lengths of shafting were either broken or condemned within two years although in every case they showed solid and good material at the fractures. The trouble seemed to be caused by deflection of the entire ship.

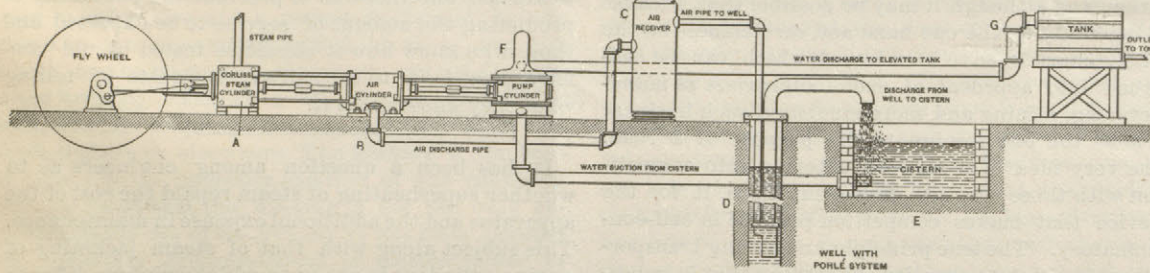
It was found in this instance that the greatest deflections vertically were one and one quarter inches and also that these occurred when the steamer's stern was high and the seas were passing the forward and center hatches. One quarter to one-half inch was frequently observed while the vessel was pitching in a head sea about ten feet forward. As indicating that the method is a fair one it is noted that with the engines stopped at sea the wire resumed its normal position as in port, and immediately upon starting in smooth water a deflection of three-eighths of an inch was found which was caused by the downward tendency of the vessel's stern due to the movement of the propeller. Quite similar results were obtained on repeating the observations upon the deck by means of sights, and it was found that a maximum deflection of two inches was noted while at sea according to the load and affected by the wave force. In a stiff head wind and sea a maximum difference of one and one-half inch vertically and one and three-quarter inches laterally was observed. Accompanying these conditions of the movement of the hull a squeaking noise was heard in the tunnel and this was traced to the couplings in which the bolts were loosened on account of stretching, showing conclusively that the theories were correct. After strengthening the hull of the steamer no further trouble was experienced.

Engineers' Club of Philadelphia.

In opening the work for the new year the president, at the meeting held February 1, 1896, made a few suggestions for the consideration of members. As there are in this city doubtless a great many men of wide engineering experience and ability who ought to belong to this club, it would be well that members who are acquainted with such men should invite them here, and they would then perhaps be sufficiently interested to join the club and aid in making its proceedings interesting. Further, as our club deals with subjects that are interesting, not simply to the engineer but also to financial men, merchants and dealers in engineering supplies, we ought also to be able to largely increase our roll of associate members.

The presentation of papers here should be in such form as to interest members of both classes, and where abstruse scientific details have to be included they could be simply referred to in passing and full details given when the paper is published. If each member will do his share in this matter, with the assistance of the membership committee and of the board of directors, we should be able to largely increase our membership during this year.

The president also reminded the meeting that in order to promote hospitality among our members and make them acquainted with each other, the gentlemen of the membership and house committees make themselves known by badges which they wear, and will be glad to introduce strangers or new members, or to make members acquainted among themselves.



THE POHLE AIR LIFT PUMP—FIG. 1.—SECTION.

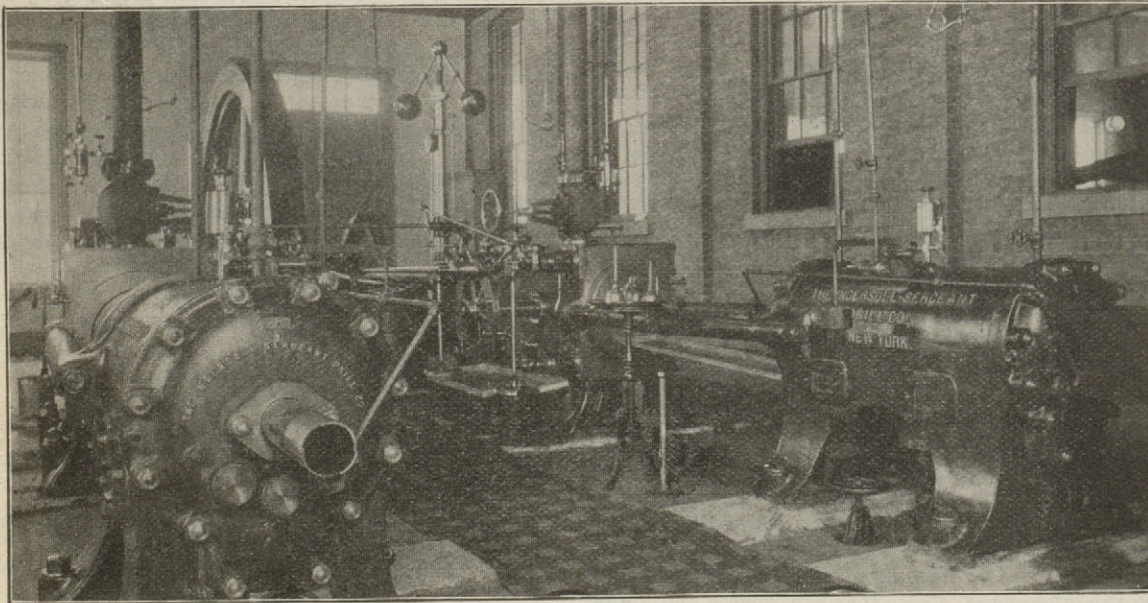
population. This committee made exhaustive examinations of the surrounding country, securing data regarding the natural supply from the watershed of the adjacent territory. The result was to the effect that the water was of such a character that it could not be used for sanitary purposes. In the summer of 1893 the Pohle air lift pump was adopted, as it was seen that with proper machinery this method would do the necessary work. The working out of the problem was successfully accomplished by E. K. Conover, the engineer of the association, and the plant was installed by the Ingersoll-Sergeant Drill Company, of 26 Cortlandt street, New York. The outfit provides for a population of upward of 100,000, the capacity being 250,000 gallons per day.

By referring to the illustration Fig. 1, the plant will be seen to consist of a Corliss steam engine, A, driving an air compressor, B, with a cylinder 18½x30 in. and a water pump, F. The plant as shown is made in

pressor is built so as to be able to run at 100 revolutions per minute, but about 75 is supposed to be its capacity. The compressor is furnished with an automatic governor and stop and also an air regulator whereby it is controlled as to speed and the pressure at which the air is delivered. The cost of the plant was about \$6,000, and it is reported to be a perfectly satisfactory means for meeting the requirements at this point.

Interstate Commerce Commission—Reasonable Rates on Wheat.

The Interstate Commerce Commission, in an opinion by Commissioner Yeomans, has announced its decision in favor of the complainants in the cases of Milton Evans and H. D. May against the Oregon Railway & Navigation Company and its receiver and others. The cases involved the reasonableness of



INGERSOLL-SERGEANT COMPRESSOR, BLOOMINGTON (ILL.) WATER WORKS.—FIG. 2.

duplicate, the engines being so proportioned that they may be run compound condensing. Steam is supplied by four return tubular boilers of 600 h. p. capacity. By means of the Pohle air lift pumps, D, the water is taken from twenty driven wells, ranging in depth from 400 to 600 ft., and from 4 to 6 in. in diameter. In this system the pump proper consists of only two plain open ended pipes. The larger of these constitutes the discharge pipe and is formed with an enlarged end piece, in which the smaller pipe enters. In pumping compressed air is forced through the air pipe into the enlarged end at the bottom of the water pipe, thence by the inherent expansive force of the compressed air, layers or pistons of air are formed in the water pipe, which lift and discharge the water layers through the upper end of the water discharge pipe.

Upon examining this illustration it will be seen that the compressed air passes from the compressing

wheat rates from Walla Walla and Dayton, Wash., to Portland, Ore. The main rulings of the commission in these cases are as follows: Prior leave of a court which has appointed the receiver of a railroad company is not necessary to entitle a shipper to complain against such receiver in a proceeding before the commission, nor is such leave necessary to give the commission jurisdiction in such a proceeding. A showing of substantial similarity in transportation conditions is necessary to make the rates of carriers in sections of the country other than that served by the defendant road proper standards of comparison in a case of alleged unjust and unreasonable charges. The wheat rates to Portland of 23½ cents per hundred pounds from Walla Walla, and 23½ cents from Dayton, when the complaints were filed, were unjust and unreasonable; a reduced wheat rate of 21½ cents per hundred pounds, put in force from both shipping points since the cases were instituted, is still above a reasonable and just charge for the service ren-

THE RAILWAY REVIEW

OFFICE OF PUBLICATION:
The Rookery, - CHICAGO, ILL.
Eastern Office: 189 Broadway, New York.

TERMS OF SUBSCRIPTION:

Per Year..... \$4.00
Foreign Subscription (including postage)..... 5.00
Convenient binders sent postpaid for \$1.00.
PUBLISHED EVERY SATURDAY: Subscribers are requested to give information of any irregularity in receiving THE REVIEW.
Rates of advertising made known on application.

All remittances should be by Draft, Express, or Money Order, payable to THE RAILWAY REVIEW.

Address all communications to THE RAILWAY REVIEW, The Rookery, Chicago.

CHICAGO, SATURDAY, FEB. 29, 1896.

THE dullness in the iron trade during the week has not uncovered the slightest weakness in prices. Mill and furnace production keeps up at even pace. Manufacturing interests feel as confident as ever of a heavy spring demand, but apart from the vague expectation there is no reason to look for more than the average trade expansion. The large purchase of rails by one corporation has not been followed by any other purchase as yet, although it is said several companies may be heard from at any time. There is nothing in sight to warrant unfavorable anticipations as to the volume of business. Mill owners are quietly expanding and improving capacity. All evidence strengthens the belief that production will be above a ten million ton pig iron basis.

In a paper read before the recent convention of the Northwestern Electrical Association, a plan for the arrangement of isolated electric lighting plants was suggested which is rather interesting. This is a part of the "Arnold" electric power station system in which the electric lighting plant consists of two engines and two dynamos arranged upon a common foundation and with one shaft which extends through from one engine to the other, the dynamos being mounted between the engines. The shaft is in three sections with couplings whereby the dynamos may be run by either engine. The novel feature is that one of the engines is run by steam and the other by gas, the former being used in the winter months when exhaust steam is required for heating the buildings, while in the summer months the electric lights are furnished by the gas engines, which permits of allowing the steam plant to remain idle during the larger part of the year. The result is a great reduction of the cost of labor during the summer months and at the same time it is possible to have a plant in duplicate with what is really only a single investment. While gas engines may be used to advantage in electric lighting, it is not economical to use them in cases where steam would have to be furnished any way for heating, and yet such an arrangement as this would seem to offer a very advantageous means for the employment of gas engines.

A SUGGESTION given by Mr. Onward Bates, in his address to the students of Purdue University upon the subject "A Railway Bridge and Building Department" should be borne in mind in drawing up specifications for the quality of work and material used in construction. He says: "I wish to warn you against what I believe is a common mistake of specifying too great refinement in the character of your work. The specification for quality is placed so high that in practice it is found convenient to reduce it, and when the work of reduction is commenced it carries other reductions with it, and the result is that you get an inferior article than might have been obtained under a less stringent specification." It is seldom that specifications are perfectly lived up to. In one sense they correspond to a law enacted for the government of a people. If it is a bad one in the sense of impossibility of enforcement it is better that it should not exist than that it should be openly violated. The result is worse than if the law had been less stringent. There is a happy medium which lies between the specifications which are so strict as to increase the price of work and those which are too lax in their requirements to insure material and work of the proper quality. Mr. Bates' rule "look on both sides" is a good one, and if this is embodied in specifications the proper me-

dium will be easier of attainment. Unusual requirements are sometimes necessary and they are usually accompanied by correspondingly high prices, but the remark quoted is intended to apply to those concerning such work as is carried out ordinarily in construction of bridges, buildings and their appurtenances.

IN THE column of "Railway Matters and Railway Men" by "The Auditor," under which pseudonym the exceedingly versatile editor of the *Railway Age* contributes to that journal some very entertaining reading matter, appears some observations upon Receiver Burleigh of the Northern Pacific and his policy of building at the shops of that company cars for other roads. An extract of the letter from Mr. Burleigh is given in which the advantages to the road of such a proposition are set forth. This extract is, however, supplemented by the statement of the editor to the effect that it is doubtful whether the scheme is either legitimate or wise, and whether it is a business in which the company can legally embark. The RAILWAY REVIEW desires to endorse the position taken by its contemporary and again place itself on record as condemning the entrance of railway companies into the mercantile field. Railroads permissibly exist for the purpose of transportation, and although it may be possible that, because of ingenuity on the one hand and carelessness on the other, charters have been issued which can be construed into approval of such enterprises as manufacturing, mining and merchandising, such business is none the less foreign to the purpose of a road. The very idea of a railroad entering into competition with those who are dependent upon it for the service that makes competition possible is self-condemnatory. The true principle underlying transportation is absolute equality, something that is impossible if self-interest is allowed to enter therein. For defense of this proposition this journal is set and it is therefore glad to welcome to its support so able an advocate as the "Auditor" of the *Railway Age*.

WHILE without doubt garnishment proceedings constitute a serious annoyance to railroad officials, it is more than questionable if the rules in force on some roads providing for the dismissal of employees on whose account such proceedings are instituted are either wise or just. Railroad employees as a class live up to their income, (and which, by the way, is none too large), so that when they have the misfortune to lose their situation for a period they necessarily become involved in debt. Naturally each creditor desires to obtain his particular pay as soon as possible, and so it happens that upon obtaining re-employment garnishment proceedings are apt to be instituted, and if the rule adopted by many roads of making a discharge the penalty for three garnishments the effect is simply to add to the embarrassment which already attaches to the individual. Further than this, the existence of such a rule is taken advantage of by disreputable collection agencies and others who deal in doubtful claims, to enforce the collection of an amount which could not be obtained by other means. Some roads, appreciating the injustice likely to be thus engendered, have abolished the rule and others where it is still retained exercise considerable discretion in its enforcement. In decriing the system it is not intended to offer any defence on behalf of those employees who habitually decline to pay their just obligations, but it is submitted that any rule to be effective must be enforced, and to enforce such a rule is to perform an injustice. It is not difficult to distinguish between the circumstances attaching to garnishment proceedings, and if an employee habitually disregards his obligations and thereby becomes a continuing annoyance to a road, he should be discharged with or without rule. On the other hand, a rule that is of such a character as to require violation in order to be just should be abrogated. It would seem, therefore, that no valid reason exists for the maintenance of such a regulation and it is to be hoped that all roads having such a rule will abolish it.

A STATEMENT was made at the January meeting of the Western Railway Club to the effect that as very little information was to be had in regard to the reasons for great differences in the service of air brake and steam hose of apparently the same quality, it is desirable to have the question taken up in the form of a paper which would give the details as to the makeup of various kinds of rubber hose and the influence of quality and manufacturing methods upon its life in service. In the discussion on car heating held at the May meeting, 1895 of this club, Mr. Gibbs stated that his experience had shown that the highest price hose in the market had been found

to be the best and most economical. There seems to be no standard by which to measure hose unless it is true that the price forms a satisfactory means of judging quality. As proper treatment of the subject requires special technical information possessed only by those who are on the inside of its manufacture, a paper upon the subject by a manufacturer of rubber would be exceedingly welcome and it does not seem necessary that any trade secrets should be divulged in order to present the subject in a manner which would greatly aid in intelligent investigation as to the quality. Mr. Gibbs said of air hose, "We are doing our part by telling what the defects are: they, (the manufacturers) on their part should help us by telling us what the inherent weaknesses of the article are and how we may avoid the use of inferior qualities which may perhaps cause us serious expense." It is a matter of fact there is no physical or pressure test which will give even an approximate idea of the service which may be expected from hose as with the mechanical test, pieces from the same shipment may vary greatly in the results given. A pressure test is of comparatively little value beyond showing that the hose at the time of the test is strong enough. The influence of wear, however, is not to be estimated from the manner in which the hose behaves under pressure. It is not thought that this material is so fickle and unreliable as to preclude the possibility of predicting the amount of service to be expected and those who know how it should be tested would confer a great favor to the railway interests by telling what they know about it.

It has been a question among engineers as to whether superheating of steam repaid the cost of the apparatus and the additional expense in maintenance. This subject along with that of steam jacketing of engine cylinders is one upon which opinions differ as to their value for what might be termed every day use, and yet there is little question of the advisability of employing these adjuncts in what might be termed high grade steam plants, which furnish the records for quoted performance. Mr. William Patchell, of London, in a paper recently read before the Institution of Mechanical Engineers, shows, however, that superheating possesses a merit in another direction which possibly has not been given sufficient consideration, namely: that by the application of the superheater together with a strengthening of the draught the capacity of a Babcock and Wilcox boiler evaporating three thousand four hundred and fifty pounds of water per hour before the superheater was used, could be made to evaporate five thousand one hundred twenty-five pounds in the same period with the changes, and in another case the evaporation had been raised to eight thousand two hundred ninety-eight pounds per hour, an increase in the capacity of the boiler of one hundred and forty per cent, without any increase of the boiler plant, and it was found that this increase could be depended upon for continuous working. Another test made by Mr. Patchell with a view of testing the abilities of the firemen, as well as the gain to be made by superheating, it was found that the boiler could be forced to three times its original evaporation before the superheater and fan had been fitted. At the present time there is insufficient data at hand to determine the size of the boiler and the effect of the draught, but disregarding this, the fact that such an increase of capacity may be produced, is of great practical value, and is surely an important achievement in engineering practice. It may have strained the boiler somewhat to produce this result, and it might not be advisable in practice to carry out the idea to the highest limit mentioned, nevertheless, the ability to increase the power of a plant for the purpose of avoiding large expense in added equipment, is an attribute of superheating which must certainly be practical and of undoubted utility upon plants which may not be necessarily expensive and refined.

DUMMY COUPLINGS FOR AIR BRAKE HOSE.

The advisability of hanging air brake hose in dummy couplings when not in use has been lately brought into prominent notice by the discussion of the paper upon air brakes on freight equipment which was read recently by Mr. A. M. Waitt before the Western Railway Club. The largest roads of the country, with very few exceptions, are following the practice of hanging the air brake hose in dummy couplings when not in use, and up to a short time ago this practice was regarded upon all roads as necessary, but there are two notable exceptions to the rule, namely, the Chicago, Burlington & Quincy and the Chicago, Milwaukee & St. Paul roads, which have abandoned the use of the dummy coupling. While this action has been regarded strange and unusual, there are some very good reasons for prefer-

ing to have the hose hang down and avoiding the kinking which is unavoidable if the hose is hung up, as this usually is done. Mr. Rhodes, of the first of the two lines mentioned, in the discussion of the paper referred to, called attention to the fact that when the hose is in use it is always hanging down, and that when the cars are moved about the yards the hose is swayed backward and forward no more than it does naturally when coupled up. The discussion brought out the fact that there is difficulty in enforcing a rule requiring the dummy couplings to be used if furnished, and it has been found that where the rule is strictly enforced a large increase in the number of damaged pieces of hose resulted. While it is held that the abolition of the dummy coupling solves the difficulty of the disposition of hose when not in use, it has been considered preferable to the use of a device which results in damage of the hose.

The best way to keep dirt out of air hose is to close the opening through which it enters the hose, and as a means for excluding dust the ordinary dummy coupling has proved itself to be an absolute failure. There is much more likelihood of getting foreign substances into the train pipe and consequently into the triple valves if the hose hung up by means of the imperfect dummy couplings than if the ends were allowed to hang down, because the end of the pipe is open in either case and a pocket is formed by the curve in the pipe which will hold all of the dirt which may be blown into the upper end of the pipe when hung up. This is an objection to the use of loose dummy coupling whether fastened upon the draft timbers or elsewhere. The kinking of the hose is caused by the improper location of the coupling, yet it is found that the kinking is not the only objection to the use of the dummy as has been pointed out. Another superintendent of motive power in the same discussion stated that he did not know any arguments which favored dummy couplings nor any which would show that the hose hung in them was any more serviceable or less liable to produce trouble than if it were allowed to hang down.

As showing the tendency of the hose to collect dust when hung up, another member found that upon unhooking the hose at the rear end of a fast mail train after a run of four hundred miles in dry weather, a collection of dust had been gathered in the bend of the hose to the amount of about one-half pint. It is evident that such a collection would not be possible if the hose was allowed to hang down. A dummy coupling which would make a tight fit with the hose coupling would of course solve the difficulty as far as dust is concerned, and such a coupling was illustrated in THE RAILWAY REVIEW of January 18, 1896, as being in use upon the Michigan Central Railway. Doing away with the collection of the dust, however, does not also eliminate the difficulty from kinking, and the best solution of the trouble which is found upon the two roads mentioned is to let the hose hang down. There would seem to be, however, another remedy worthy of thorough trial before giving up the dummy coupling permanently, unless the coupling itself is to be closed against the entrance of dirt, and that is to use a tight dummy so located with reference to the end of the train pipe as to admit of hanging the hose in a semi-circular form without kinking. It is believed that this can be done and the advantage to be gained would be the exclusion of the small amount of dust which is now retained by the pocket formed by the coupling itself when allowed to hang down. The arguments against the use of a dummy coupling are all based upon the one in use at the present time, which apparently might to advantage be replaced by one which would make a tight joint, and as far as can be seen there would be no attendant disadvantages except the fact that the hose when hung in any dummy receives a different curve from that which it occupies when in service.

COMPETITION IN RAILWAY SERVICE.

An interesting development of the idea of competition was recently seen in the office of the general superintendent of a large road which consisted of a comparative statement of the items of the cost of operation of the road which were most needed by the general officers, giving the cost of conducting transportation in cents per ton mile, the average tons per train mile, the average loading of each car and the total operating expenses for each division, whereby the records of the division superintendents could be compared with their own and those on other divisions. The table was arranged in such a way as to enable the officers to see at a glance the relative cost per ton mile of freight hauled, and it also enabled them to ascertain the amount of dead load hauled in order to conduct this business. The comparisons were interesting and showed a gradual in-

crease in the average load per car, a decrease in the cost of hauling freight per ton mile, year for year, for several years. There is another direction in which this plan might be advantageously followed, and in which so far as is known, it has not yet been applied, namely, in connection with the cost of doing work in repair shops. To this work the performance sheet seems excellently adapted and it is believed that great reductions of expense could be obtained if the cost of work at different division shops could be compared as are the locomotive records.

It is noticeable that few shop foremen—and perhaps this can also be applied to somewhat higher officers—know even approximately the cost of work done under their direction. For instance, it would be necessary in most cases to look up the time of the men employed upon such work as turning up piston rings, boring tires, or similar processes, in order to ascertain the cost per piece for doing the work. Recently the general foreman of a large car shop was asked the cost of one of the simple processes and he was unable to reply definitely but went to the man who was occupied on the work to ascertain the time occupied. The officer desiring the information, then asked why the exact cost was not known. It had never occurred to the foreman that it was necessary that it should be known, but when asked if it would not be strange for a man in charge of a contract shop to be ignorant of the cost of work, he replied that the case was very different, where the product was to be sold for a price. The question comes naturally into mind as to wherein there is any difference between the contract shop and the railroad shop in this particular. A railroad is a business concern and it is very necessary to know that the work in each particular shop is done to the best advantage. For this purpose it is necessary that each shop's record shall show the exact cost per piece in order that accurate comparisons may be made and the proper remedy applied. The officers of the mechanical department of several large roads are developing methods of comparing the shop performance of the different divisions and good results are to be expected in consequence of the competition engendered. If the master mechanics of the various divisions are brought together to compare notes as to the expense of doing certain work, and find that one of them has greatly distanced others in regard to the cheapness of any particular operation it becomes a matter of interest to ascertain what conditions contributed to the decreased expenses, and the result would be improvements in the methods of all, looking to the duplication of the best record.

This is an excellent field for competition, and while conditions are not exactly parallel to those governing work in contract shops, the results of the competition will not only reduce the prices, but improve the quality of service of the men and increase the output of shop plants, all of which tend to offset the decline of rates, which is so troublesome a question to railway managements. The action of the Western Railway Club in memorializing the Master Mechanics' Association, urging the adoption of the ton-mile unit for comparison of repairs as well as cost of fuel is an important step, and one which will undoubtedly result in the improvements which can only be obtained through proper methods of comparison. In the case first mentioned the division officers became interested in producing the best possible records for their respective divisions, and as the standing of each was put before the general officers every month, it became a matter of pride to show the greatest improvements. In the absence of these records, however, there is likely to be a corresponding absence of effort to secure low cost of operation. There must be a lack of incentive where attention is never called to the cost of operation, and it is easy to see why men, as well as officers may grow to disregard cost altogether in other departments as well as in the shops. A man who is trying to cheapen his work should be given proper credit for what he accomplishes. It is believed that there are many cases in the organization of a railway where a few records which need not be expensive to keep will, by tending to show men that their work has a money value to the company, by showing them what that value is, compared to those of other individuals, and compared to themselves in the past, will urge them to such efforts as are necessary to retain a position in manufacturing lines.

The vapor from gasoline used in cleaning carpets in a Pullman car at Pittsburgh, Pa., was exploded by fire in the heater, on Feb. 15, smashing the windows and interior fittings, and injuring three of the car cleaners.

SOME OF THE PROPERTIES OF WOOD.

The additions to the literature upon the subject of timber which have been made in the form of bulletins issued from time to time by the Forestry Division of the Department of Agriculture have been of very great value, and the latest bulletin, which is number 10, is not an exception to the rule. This is entitled "Timber," and is by Mr. Filibert Roth, special agent in charge of timber physics under the direction of Mr. B. E. Fernow, chief of the division of forestry. The following paragraphs are taken from the bulletin:

In the shop the fitness of the wood for a given purpose never depends on any one quality alone, but invariably upon a combination of several qualities. A spoke must not only be strong, it must be stiff to hold its shape, it must be tough to avoid shattering to pieces, and it must also be hard or else its tenons will become loose in their mortises.

Selecting wood in this way, the woodworker has learned almost all that is at present known about his material, but in many cases the great difficulty which always attends the judgment of complex phenomena has led to erroneous conclusions, and not a few well-established beliefs have their origin more in accidental error of observation than in fact.

The experimenter endeavors to avoid this complexity by testing the wood for each kind of resistance separately; when tested as to their stiffness, the pieces are all shaped, placed and loaded alike. The wood is selected with a definite object in view; it is green or dry, clear or knotty, straight or crossgrained, according as he wishes to find out the influence of each of these conditions. If pine and oak are to be compared, the pieces are from the same position in the tree and are tried under exactly the same conditions, and thus the case is simplified.

But even results thus arrived at cannot be used indiscriminately, and the figures on the strength of oak given in any book must not be supposed to apply to all oak, if tested in the given manner. This is due to the fact that a piece of wood is not simply a material but a structure, just as much as a railroad bridge or a balloon frame, and as such varies greatly even in the wood of the same tree, nay, more than that, even in the same year's growth of the same cross section of a log.

Cutting out a piece 2 x 4 in. and 4 ft. long, placing it flatwise so that it is double the width of the former stick and loading it with 100 lbs. we find it bending only one-sixteenth inch; doubling the width doubles the stiffness.

Setting the same 2 x 4 in. piece on edge, so that it is 2 in. wide and 4 in. deep, the load of 100 lbs. bends it only about one sixty-fourth in.; doubling the thickness increases the stiffness about eight fold.

It follows that if we double the length and wish to retain the same stiffness we must also double the thickness of the piece.

A piece of wood is usually stiffer with the annual rings set vertically than if the rings are placed horizontally to the load.

Cross-grained and knotty wood, to be sure, is not as stiff as clear lumber; a knot on the upper side of a joist, which must resist in compression, is however, not so detrimental as a knot on the lower side, where it is tried in tension.

Every large timber which comes from the central part of the tree contains knots, and much of its wood is cut more or less obliquely across the grain, both conditions rendering such material comparatively less stiff than small clear pieces.

The same stick of pine, green or wet, is only about two-thirds as stiff as when dry. A heavy piece of long leaf pine is stiffer than a light piece; heavy pine in general is stiffer than light pine, but a piece of hickory, although heavier than the pine, may not be as stiff as the piece of long leaf pine, and a good piece of larch exceeds in stiffness any oak of the same weight.

Unlike the stiffness, the strength of a timber varies approximately with the squares of the thickness and decreases directly with increasing length and not with the cube of this latter dimension. Thus, if our piece 2 x 2 in. and 4 ft. long can bear 1,000 lbs. before it breaks, a 2 x 4 in. laid flat will break with about 2,000 lbs., and if set edgewise, it requires about 4,000 lbs. to break it, while a piece of the same kind of 2 x 2 in., and double the length (8 ft.) breaks with one-half the original load, or only 500 lbs.

In general wet or green wood shears about one-third more easily than dry wood; a surface parallel to the rings (tangential) shears more easily than one parallel to the medullary rays. The lighter conifers and hard woods offer less resistance than the heavier kinds, but the best of pine shears one-third to one-half more readily than oak or hickory indicating that great shearing strength is characteristic, of "tough" woods.

It has been stated that heavy wood is stronger than lighter wood of the same kind, and that seasoning increases all forms of resistance. Let us examine why this is so.

Since the weight of dry wood depends on the number of fibers and the thickness of their walls, there must be more fibers per square inch of cross-section in the heavy than in the light piece of the same kind, and it is but natural that the greater number of fibers should also offer greater resistance, i. e., have the greater strength.

The beneficial influence of drying and consequent shrinking is two fold: (1) In dry wood a greater number of fibers occur per square inch, and (2) the wood substance itself, i. e., the cell walls, become firmer. A piece of green long leaf pine, 1 x 1 in. and 2 in. long, is only about 0.94 x 0.96 in. and 2 in. long when dry; its cross section is 10 per cent smaller than before, but it still contains the same number of fibers. A dry piece 1 x 1 in., therefore, contains 10 per cent more fibers than a green piece of the same size, and it is but fair to suppose that its resistance or strength is also about 10 per cent greater.

The influence of the second factor, though unquestionably the more important one, is less readily measured. In 100 cu. in. of wood substance the material of the cell walls takes up about 50 cu. in. of water and thereby swells up, becoming about 150 cu. in. in volume. In keeping with this swelling the substance becomes softer and less resistant. In pine wood this diminution of resistance, according to experiments, seems to be about 50 per cent, and the strength of

the substance therefore is inversely as the degree of saturation or solution.

Heavy wood is harder than lighter wood; the wood of the butt, therefore, is harder than that of the top; the darker summer wood harder than the light colored spring wood. Moisture softens, and seasoning therefore, hardens wood.

Placing the rings vertically helps the wood to resist indentation. Though harder wood resists saw and chisel more than softer wood, the working quality of the wood is not always a safe criterion of its hardness.

From the foregoing considerations a few valuable facts, mostly familiar to the thoughtful woodworker, may be deduced:

In framing, where light and stiff timber is wanted, the conifers excel; where heavy but steady loads are to be supported, the heavy conifers, hard pine, spruce, Douglas spruce, etc., answer as well as hardwoods, which are costlier and heavier for the same amount of stiffness. On the other hand, if small dimensions must be used, and especially if moving loads are to be sustained, hard woods are safest, and in all cases where the load is applied in form of "shocks" or jars, only the tougher hardwoods should be employed. The heavier wood surpasses the lighter of the same species in all kinds of strength, so that the weight of dry wood and the structural features indicative of weight may be used as safe signs in selecting timber for strength.

In shaping wood it is better, though more wasteful, to split than to saw, because it insures straight grain and enables a more perfect seasoning.

For sawed stock the method of "rift" or "quarter" sawing, which has so rapidly gained favor during the last decade, deserves every encouragement. It permits of better selection and of more advantageous disposition of the wood; rift sawed lumber is stronger, wears better, seasons well, and is least subject to "working" or warping.

All hardwood material which checks or warps badly dur-

All wood is equally durable under certain conditions. Kept dry or submerged it lasts indefinitely. Pieces of pine have been unearthed in Illinois, which have lain buried 60 or more feet deep for many centuries. Deposits of sound logs of oak buried for unknown ages have been unearthed in Bavaria; parts of the piles of the lake dwellers, driven more than 2000 years ago are still intact.

Wood cut in the fall is more durable than that cut in summer only because the low temperature of the winter season prevents the attack of the fungi, and the wood is thus given a fair chance to dry. Usually summer felled wood on account of prevalent high temperature and exposure to sun, checks more than winter felled wood, and since all season checks favor the entrance of both moisture and fungus they facilitate destruction. Where summer felled wood is worked up at once and protected by kiln drying no difference exists. The phases of the moon have no influence whatever on durability.

In sawing timber much of the wood is bastard cut; at these places water enters much more readily, and for this reason split and hewn timber and ties generally resist decay perhaps better than if sawed.

The attacks of beetles as well as those of the ship worm can not here be considered; like chisel or saw they are mechanical injuries against which none of our woods are proof.

RANGE OF DURABILITY IN RAILROAD TIES.

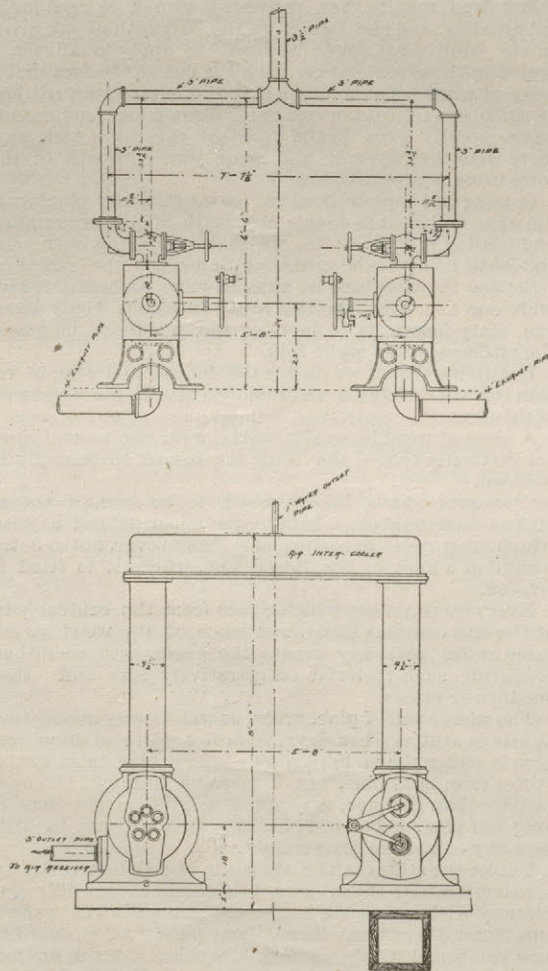
Years.	Years.
White oak and chestnut oak.....8	Redwood.....12
Chestnut.....8	Cypress and red cedar.....10
Black locust.....10	Tamarack.....7 to 8
Cherry, black walnut, locust.....7	Longleaf pine.....6
Elm.....6 to 7	Hemlock.....4 to 6
Red and black oaks.....4 to 5	Spruce.....5
Ash, beech, maple.....4	

The durability of wood exposed to the changes of the weather, and where painting, after thorough seasoning, is impracticable, is increased by impregnating it with vari-

valves, which are to be seen in the illustration. A speed governor and air regulator are furnished, which are so arranged as to stop the compressor automatically when a specified air pressure is reached and to start the machine again upon a reduction of the pressure below that point.

The compressor has a capacity of 300 cu. ft. of free air when running at 70 revolutions per minute, or 427 cu. ft. of free air when running at 100 revolutions per minute. It will compress air to 125 lbs. with a steam pressure of 80 lbs per sq. in. This company has for a number of years made a close study of the subject of air compression, and while it is admitted that there is much yet remaining to be learned in this connection, it has used every effort to advance this line of machinery in every possible way leading to the economical compression of air for use in manufacturing as well as other lines of mechanical work. It has a great variety of types of compressors for every use to which compressed air is put, and has been the means of introducing a large number of improvements. That the officers of railways appreciate the efforts made by the manufacturers to meet the requirements of economical air compression is evident from the present tendency toward employment for this purpose of properly designed machinery of high grade.

The compressor shown in this illustration is now being set up in one side of a building at the West Chicago shops, the whole of which was formerly used for the electric light plant. The latter plant has been rearranged so as to occupy about one-half



THE DUPLEX AIR COMPRESSOR FOR CHICAGO & NORTHWESTERN RAILWAY BY THE RAND DRILL CO.

ing seasoning should be reduced to the smallest practicable size before drying, to avoid the injuries involved in this process; and wood once seasoned should never again be exposed to the weather, since all injuries due to seasoning are thereby aggravated. Seasoning increases the strength of wood in every respect, and it is therefore of great importance to protect wooden structures, bearing heavy weights, against moisture.

Knots, like cross-grain and other defects, reduce the strength of timber. Where choice exists, the knotty side of the joist should be placed uppermost, i. e., should be used in compression.

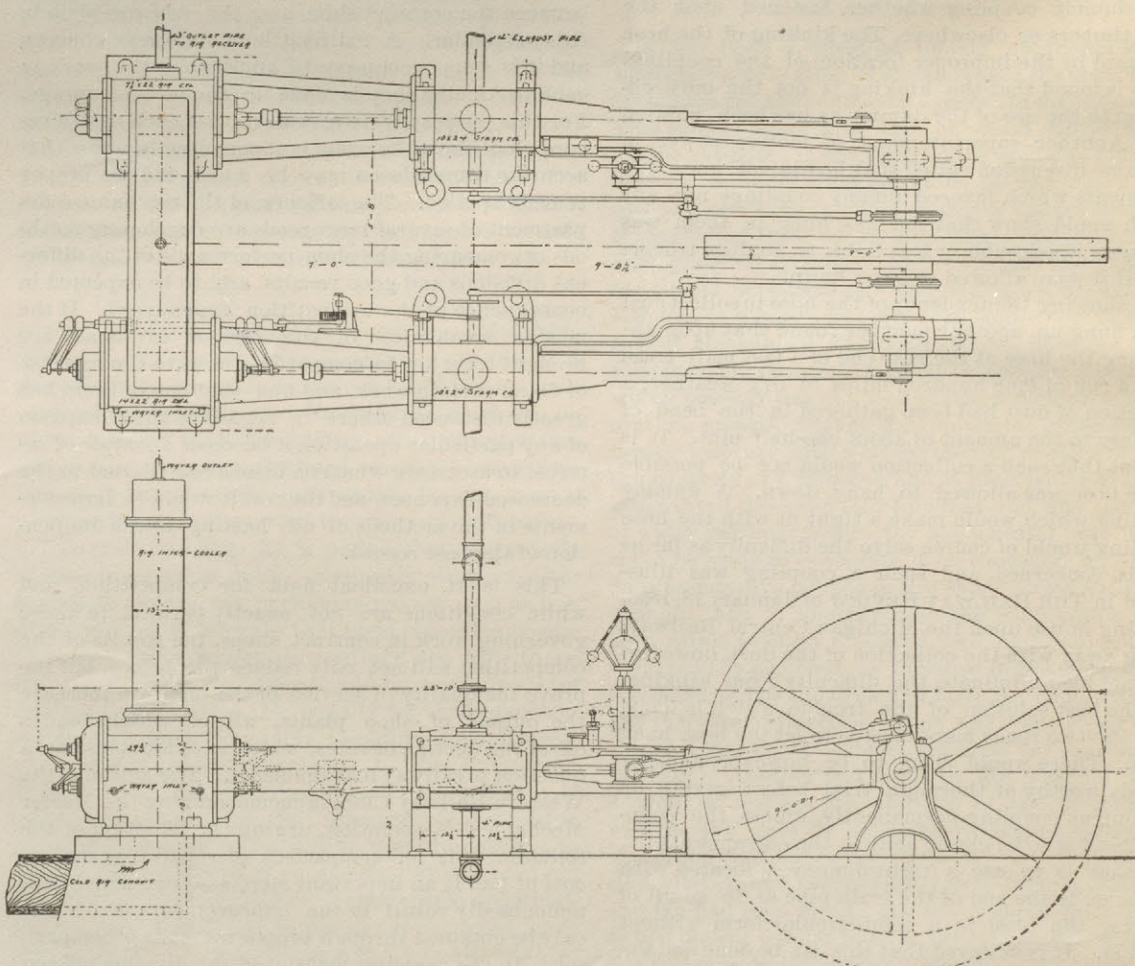
Season checks in timber are always a source of weakness; they are more injurious on the vertical than on the horizontal faces of a stringer or joist, and their effect continues even when they have closed up, as many do, and are no longer visible.

Rafted timber, kiln dried or steamed lumber are, as far as our present knowledge extends, as strong as other kinds, and wherever any of these processes aid in a more uniform or perfect seasoning, it increases the strength of the material.

Pine "bled" for turpentine is as strong as "unbled".

Time of felling, whether season of the year or phase of the moon, does not influence strength, except that summer felled hardwood rarely seasons as perfectly as that felled in the fall, and to this extent an indirect influence may be observed, as well as by the fact that fungi and insects have a better opportunity for developing.

Warm countries and sunny exposures generally produce heavier and stronger timber, and conditions favorable to the growth of the species also improve its quality. But, exceptions occur; neither fast nor slow growth is an infallible sign of strong wood, and it is the character of the annual ring, rather than its width, and particularly the proportion of summer wood, which determines the quality of the material.



THE RAND AIR COMPRESSOR-CHICAGO & NORTHWESTERN RAILWAY SHOPS.

The fact that the Chicago & Northwestern Railway has purchased a large air compressor for use at its West Chicago shops, has already been noted in these columns. The machine selected for this purpose is manufactured by the Rand Drill Company and embodies its latest improvements. It is duplex, and is fitted with Corliss steam engines with steam cylinders 10 in. in diameter add 24 in. stroke. The air cylinders are of the latest pattern, cross compound type, with a low pressure cylinder 14 in. in diameter, high pressure cylinder 17½ in. in diameter by 24 in. stroke. It is arranged with an inter-cooler placed above the air cylinders, and shown in the accompanying illustration. The air will pass through this cooler on the way from the low pressure to the high pressure cylinder. The cooler consists of a cylinder which is divided into small pipes through which the air passes and around which cold water circulates. The low pressure air cylinder is fitted with Rand's latest improved mechanical air

of the space given to it formerly. The conduit for the inlet air passes through the floor of the building and takes the air from outside at the lowest available temperature. The outlet pipe from the compressor passes to large storage tanks, and thence into an extensive piping system, which includes the locomotive shops, car shops and the repair yards, which are very extensive. The compressor takes the place of a large number of air brake pumps which were found to be inadequate for the purpose. The small pumps were distributed in different parts of the works, and the high esteem in which pneumatic power is held is shown by the fact that a large amount of new piping has just been put in. The large compressor will enable the use of air apparatus to be extended, and designs are now in hand for transversing and other cranes to be operated by this power, which will greatly facilitate the work in these shops.

NOTICES OF PUBLICATIONS.

AMERICAN STEAM AND HOT WATER HEATING PRACTICE.—From the Engineering Record. Being a selected reprint of descriptive articles, questions and answers with 585 illustrations. The Engineering Record, New York, 1895.

The preface of this valuable book states that the "Engineering Record" has for 16 years paid special attention to its department of ventilation and steam and hot water heating. Beside the weekly illustrated descriptions of current work in this field a great variety of questions which have been received were answered, and in 1888 the book entitled "Steam Heating Problems" was published.

This gave a selection of questions and answers, and descriptions which had been published within the nine preceding years and dealt mainly with steam heating. The present book is intended to supplement the former publication, and includes a selection from descriptions of recently installed plants, prepared by the staff of The Engineering Record, and in addition to this a number of questions and answers are included which have been prepared since 1888, during which time hot water heating has become popular. The best recommendation of the book is that it represents current practice and contains precedents which will be found very valuable to engineers and others who have problems in heating and ventilating to work out. All classes of buildings are included and the illustrations are frequently dimensioned, and in nearly all cases the cubical contents of the rooms are given. A chapter treating of railway shops describes the plant at the Tacoma shops of the Northern Pacific which is very fully illustrated. The Springfield stations of the Boston & Albany Railroad and the roundhouse plant at Port Huron on the Chicago & Grand Trunk Railway are illustrated. In addition to these the hot water system used on one of the New York elevated roads is described, and also the vacuum system as applied at the 31st street plant of the Minneapolis Electric Street Railway. The illustrations as a rule are excellent, and the variety and apparent reliability of the information presented renders the book a specially valuable one for those who have to do with designing construction of heating and ventilating plants.

JOURNAL OF THE WESTERN SOCIETY OF ENGINEERS. Vol. 1. No. 1. Papers, Discussions, Abstracts, Proceedings. Standard size, 6 x 9, 144 pp., paper. Illustrated. Chicago, January, 1896.

The first number of the new journal of the Western Society of Engineers has just been received, and those who have looked for a publication containing interesting and valuable information satisfactorily arranged and illustrated will not be disappointed. The letter press is good, the type well selected and the whole appearance of the journal is highly creditable to the society. The papers presented are as follows: "Notes on Dry Docks of the Great Lakes," by A. V. Powell; "Oriental Railways," by Clement F. Street; "New Experimental Data for Flow over a Broad Crest Dam," by Thos. T. Johnston and Ernest L. Cooley; "Lakes and Atlantic Waterways," compiled by the publication committee; "Topical Discussion upon Hydraulic Cement," by Messrs. Noble, Noyes, Cooley and Baker; "Silica-Portland Cement," by Chas. SooySmith, discussed by J. W. Dickenson; "Cement and Cement Mortars," by Thos. T. Johnston. In addition to these papers there are several abstracts of papers which have appeared in other publications upon interesting subjects. The pamphlet closed with a memorial of General Orlando M. Poe with an excellent half-tone engraving from a photograph of the general in uniform, and the minutes of the recent annual meeting. The color of the cover, a terra cotta, while striking, is not particularly attractive, and an improvement might be added in the form of putting the title, date and volume number upon the back of the book, where it would readily catch the eye in standing upon a shelf. The volume is accompanied by a series of large plates in a pocket furnished as a supplement. These show the shallows and obstructions along the natural water routes from Chicago and Duluth in the west to Quebec and New York in the east via the Great Lakes, the St. Lawrence river and the Champlain-Hudson Valley all referred to mean tide at New York. The scale adopted is one centimeter to each ten feet vertical, and one centimeter per mile horizontal. These profiles are of great value in discussing the subject of water routes through the lakes, and the compilation has not been made before on account of the great labor and time required to bring together the scattered items and present them on a basis of accuracy.

HOME STUDY.—An elementary journal for students of plumbing, architecture, mining, mechanics, electricity, drawing, steam engineering, etc.

This is a new monthly paper which has just been started by the Colliery Engineer Co. of Scranton, Pa. It is designed to meet the requirements of students of the industrial sciences and readers of technical journals who desire simple and concise explanations of ordinary technical and scientific subjects. The paper is neat in appearance and is carefully edited. The explanations are clear and it would seem that it is likely to fulfill its object admirably. The departments at the present time cover steam engineering, architecture, plumbing, heating and ventilation, geometry, practical drawing, mining, civil engineering, electricity, and mechanics.

A pamphlet has just been received from Mr. T. G. Winnett, general passenger and freight agent of the Detroit & Mackinac Railway, which indicates that railway advertising is on the up grade. It is filled with pretty views of the summer resorts reached by this line, and interspersed among these are most tantalizing engravings of strings of fish and bags of game which are to be duplicated during every season. Attention is also paid to the business opportunities of the region, and altogether the effect of an examination of the illustrations is to inspire a wish to spend one's very next vacation there. For copies, address Mr. Winnett at East Tawas, Mich.

A new railroad map of the state of Illinois, bringing the railways and the list of crossings equipped with interlocking and signaling devices up to date, has just been received from M. Dwight C. Morgan, consulting engineer of the Railroad and Warehouse Commission of the state. This map is conveniently arranged for displaying upon a wall and is intended for use in offices. One hundred and one interlocking plants are included in the table, and these maps, as they are received annually, give an idea of the increase in the number of these devices that are put in use in the state. As an illustration of the rapid increase of these plants it should be stated that the number installed up to the close of 1893 was sixty, and this is probably a larger rate of increase than can be shown for any western state.

American Association of General Passenger and Ticket Agents.

The forty-first annual meeting of this association will be held at the Hotel Jefferson, Richmond, Va., at 11 o'clock a. m., Tuesday, March 17, 1896. Action upon the report of

the committee having in charge the matter of a better control of the issuance of interline passage tickets should be disposed of at this meeting. Col. C. P. Atmore is chairman of the committee.

The chairman of the committee appointed to report on the question of pasteur contracts, Mr. A. S. Hanson, will, it is expected, make a final report at this meeting.

Mr. B. W. Wrenn will deliver the annual address.

TECHNICAL MEETINGS.

The American Society of Civil Engineers holds meetings on the first and third Wednesdays in each month, at 8 p. m., at the House of the Society, 127 East Twenty-third street, New York City.

The American Society of Irrigation Engineers. Third annual meeting will be held at Albuquerque, N. M., September 16-19. John L. Titcomb, secretary, 36 Jacobson block, Denver, Col.

The Association of Civil Engineers of Cornell University meets weekly every Friday, from October to May inclusive, at 2:30 p. m., at Lincoln Hall, New York.

The Association of Engineers of Virginia, holds its informal meetings on the third Wednesday of each month from September to May inclusive, at 8 p. m., at 710 Terry building, Roanoke, Va.

The Boston Society of Civil Engineers, meets monthly on the third Wednesday in each month, at 7:30 p. m., at Wesleyan Hall, 36 Bromfield street, Boston, Mass.

The Canadian Society of Civil Engineers meets every other Thursday at 8 p. m., at 112 Mansfield street, Montreal, P. Q.

The Foundrymen's Association meets monthly on the first Wednesday of each month, at the Manufacturers' Club, Philadelphia, Pa.

The International Irrigation Congress will hold its fourth session at Albuquerque, N. M., September 16-19. Fred L. Alles, secretary, Los Angeles, Cal.; local secretary, W. C. Hadley, E. M., Albuquerque, N. M.

The Montana Society of Civil Engineers meets monthly on the third Saturday in each month, at 7:30 p. m., at Helena, Mont.

The New England Railroad Club meets on the second Tuesday of each month, at Wesleyan Hall, Bromfield street, Boston, Mass.

The New York Railroad Club has a monthly meeting on the third Tuesday in each month, at 8 p. m., at 12 West Thirty-first street, New York City.

North-West Railway Club meets alternately at the West Hotel, Minneapolis, and the Ryan House, St. Paul, on the second Tuesday of each month.

The Northwestern Track and Bridge Association meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m., at the St. Paul Union Station, St. Paul, Minn.

The Southwestern Society of Mining Engineers will hold a session at Albuquerque, N. M., September 16-19. Walter C. Hadley, secretary, Albuquerque, N. M.

The Southern & Southwestern Railway Club holds its meetings on the third Thursday of January, April, August and November, at the Kimball House, Atlanta, Ga.

The Western Foundrymen's Association holds its meeting on the third Wednesday in each month, at the Great Northern Hotel, Chicago, Ill.; secretary, S. T. Johnston, 1522 Monadnock building.

The Western Railway Club of Chicago, holds its meeting on the third Tuesday of each month.

The Central Railway Club meets on the fourth Wednesday of January, March, April, September and October, at 10 a. m., at the Hotel Iroquois, Buffalo, N. Y.

The Technical Society of the Pacific Coast has a monthly meeting on the first Friday in each month at 8 p. m., at the Academy of Sciences building, 819 Market street, San Francisco, Cal.

The Civil Engineers' Club of Cleveland, meets on the second and fourth Tuesdays in each month, at 8 p. m., at the Case Library building, Cleveland, Ohio.

The Denver Society of Civil Engineers meets on the second and fourth Tuesdays in each month except July, August and December, when they are held on the second Tuesday only, at 36 Jacobson building, Denver, Colo.

The Engineers' and Architects' Club of Louisville has a monthly meeting on the second Thursday in each month, at 8 p. m., at the Norton building, Fourth avenue and Jefferson street, Louisville, Ky.

The Engineering Association of the South meets on the second Thursday of each month at 8 p. m., at the Cumberland Publishing House, Nashville, Tenn.

The Engineers' Club of Cincinnati has a monthly meeting on the third Thursday in each month, at 7:30 p. m., at the Literary Club, 24 West Fourth street, Cincinnati, O. Address P. O. Box 333.

The Engineers' Club of Minneapolis holds its meetings on the first Thursday in each month, at Public Library building, Minneapolis, Minn.

The Engineers' Club of Philadelphia meets on the first and third Saturdays in each month, at 8 p. m., at the house of the club, 1122 Girard street, Philadelphia, Pa.

The Engineers' Club of St. Louis meets on the first and third Wednesdays of each month, at the Missouri Historical Society building, Sixteenth street and Lucas place, St. Louis, Mo.

The Engineers' Society of Western Pennsylvania holds its monthly meeting on the third Tuesday of each month at 7:30 p. m., at the Carnegie Library Building, Allegheny, Pa.

PERSONAL.

Mr. James Keavy, general agent of the Cleveland, Cincinnati, Chicago & St. Louis at Grand Rapids, Mich., has been appointed district freight agent of the same road, with headquarters at Benton Harbor, Mich.

Mr. Taylor Payne was elected a director of the Delaware, Lackawanna & Western Railway Company to succeed the late George Bliss. The members of the old board were all re-elected, and those re-elected the old officers.

Mr. G. H. Branstom has been appointed New England passenger agent of the Burlington, vice H. D. Badgely, who resigned to accept the assistant general passenger agency of the Chicago Great Western. Mr. H. E. Keller, dis-

trict passenger agent of the Burlington at Allentown, Pa., has had his territory extended to include part of Virginia and West Virginia.

Some of the changes made necessary owing to the new arrangements on the St. Louis & San Francisco are as follows: Mr. J. H. Cook will be in charge of the Chicago agency; Mr. H. B. Franklin will be located at Cincinnati; Mr. O. M. Conley at Pittsburgh, while Mr. N. L. Van Nest will be in charge of the office at New York. These agencies are expected to be in running order by March 1.

After March 1 Starr Kealhofer, at present chief rate clerk in the office of W. D. Hurlbut, assistant general freight agent of the Illinois Central, will be commercial agent of the Central of Georgia Railway. Mr. Kealhofer will succeed F. L. Drake, who has resigned. F. P. Redman will succeed Starr Kealhofer as chief rate clerk in the office of Mr. Hurlbut of the Illinois Central. He has been connected with the Valley road for several years, having formerly been lost freight agent.

A number of changes have been made in the mechanical department of the Chicago, Burlington & Quincy road, among which are the following: Mr. F. A. Chase, at present master mechanic of the Kansas City, St. Joseph & Council Bluffs, is made master mechanic of the Missouri lines, with headquarters in St. Joseph. Mr. I. N. Wilbur is made division master mechanic at Hannibal to succeed Mr. N. J. Paradise, deceased. Mr. C. E. Lamb of St. Louis is made superintendent of the mechanical department at Brookfield, an Mr. Joseph Clough of Kansas City will succeed Mr. Lamb at St. Louis. The jurisdiction of Mr. Joseph Richardson at Kansas City is extended over the Hannibal & St. Joseph and the Kansas City, St. Joseph & Council Bluffs at Kansas City. These changes will be effective March 1.

An official circular announces that the Lehigh Valley Railroad Company having acquired control of the Elmira, Cortland & Northern Railroad, the duties of the following traffic officers of this company are extended to cover that line: John H. Heckman, general freight agent, South Bethlehem, Pa.; Asa L. Foster, through freight agent, Philadelphia; Bert. Hayden, division freight agent, Sayre, Pa.; George S. Taylor, coal freight agent, Philadelphia; Chas. S. Lee, general passenger agent, Philadelphia; A. W. Nonnemacher, assistant general passenger agent, South Bethlehem, Pa. Mr. C. W. Williams, heretofore general freight and passenger agent of the Elmira, Cortland & Northern Railroad, has resigned, the resignation having taken effect Feb. 21.

Mr. Samuel D. Davis, first vice president of the Columbus, Hocking Valley & Toledo Railway, has appointed Mr. W. A. Mills general manager of the road. Mr. Mills is a native of Ohio, having been born at Delaware, August 26, 1850. He began his railroad career February 7, 1870, as chief clerk in the general ticket and freight agent department of the Hocking Valley. He had charge of the freight branch of the department, being virtually the first general freight agent of the road. This position he held for three years and six months when he was given the title of general freight and ticket agent. After having discharged the duties of this responsible position for six years and three months the departments were separated and he was made general freight agent. At the expiration of one year and eight months he resigned this position to accept the general freight agency of the Columbus & Toledo. From August, 1880, to September, 1881, he was in charge of the freight department of the Ohio & West Virginia, but September 1, 1881, he returned to the Hocking Valley as general agent, and February 22, 1893, he was appointed assistant to the late President Waite. The position of president will be filled at the annual meeting of the road which occurs on March 17 next in New York.

Mr. David Kinnear Clark whose name is well known to every engineer, died at his home in Buckingham street, London, on Jan. 22 at the age of 74 years. For years Mr. Clark's pen has been active in revision and compilation rather than original work, having in 1887 brought out "Manual of Rules, Tables and Data for Mechanical Engineers" a volume containing 984 pages. When young Mr. Clark served his apprenticeship at the Phoenix Iron Works at Glasgow and afterward became mechanical engineering draftsman at M. John Miller's once famous civil engineering office in Edinburgh, an office still known and closely identified with railway work. While in this office he acted for two years as assistant editor of the Practical Mechanic and Engineers Magazine, after which he was for two years engineer in chief to the Deep Fisheries Association, returning to Scotland in 1853 as locomotive superintendent of the Great North of Scotland Railway. While holding this position he accumulated the information embodied in his book on Railroad Machinery, which although containing many reorganized errors may still be classed as a standard production on the locomotive. This work was dedicated to Robert Stephenson and occupied in preparation six years, during which the author visited nearly all the great railway stations in the country in search of knowledge of working plant. The most important of his recent work is The Steam Engine in two volumes, which was published only three years ago. He also published minor books and contributed many papers to the Institution of Civil Engineers becoming an associate member of that organization in 1863.

Mr. William J. Morden, who is at the head of one of the greatest railway supply manufactories in the country, died at 10:55 o'clock on the morning of Feb. 27, at his residence, 1508 Michigan avenue. Although Mr. Morden had been confined to the house for several weeks his death was unexpected, as he had been thought to be improving for several days previous. About two weeks ago Mr. Morden was bitten on the end of the right forefinger by a pet parrot. The finger, hand, and finally the entire arm swelled to a great size. When this began to improve a liver trouble that had attacked Mr. Morden some years ago, began to assert itself, and also symptoms of a recurrence of paralysis, with which he was first attacked seven years ago. The physicians incline to the opinion that blood poisoning from the parrot's bite was the principal cause of death. Mr. Morden was 65 years old and was born a Painesville, Ohio. He began work as a water carrier to the crew of a construction train. He steadily rose in the railway service, and, being of a studious nature, with a natural talent for

mechanics, soon attracted attention by a number of railway devices which he perfected. From minor improvements he began to turn his attention to invention exclusively, and soon had innumerable patents upon railroad crossings, frogs and lighting and signal devices which are now in use in America and Europe. His latest achievement was an electrical locomotive which generates a portion of its own electricity as it travels, and heats and lights the train it draws. The patents for this had just been secured and the contracts let for the construction of one of the engines. Mr. Morden came from Indianapolis to Chicago in 1880 and started the Morden Frog & Crossing Works on Pacific avenue, near the Lake Shore station. The business grew until its quarters in that vicinity were too small, and in 1884 the present big plant at South Chicago was started.

RAILWAY NEWS.

Chicago & Eastern Illinois.—The principal improvements made, and construction done, on the Chicago & Eastern Illinois Railroad during the year 1895, are as follows: 9.46 miles of side tracks and coal spurs have been built; some 30,000 or more yards of gravel was put under the track on main line, between Muncie and Dolton, and 4.22 miles of eighty pound steel rail was laid between Bismarck and West Newell, replacing sixty-pound steel rail. About 9 miles more of eighty pound steel rail will be laid as soon as possible. On the Brazil division one eight foot and one twelve foot stone arch culvert has been built just north of Kingman, Ind., replacing two pile trestles of 248 and 195 feet respectively, which have been filled up. Indiana paving brick was used for the top of these arches, and found to be much cheaper and, it is believed, as good as stone. Near Rob Roy, on the same division, a steel viaduct was erected over Big Shawnee creek. This viaduct consists of five fifty-five foot, and four thirty foot plate girders, erected on steel towers, with first class masonry foundations, and is located twenty feet to the east, and twelve feet above a four hundred foot pile trestle, which it takes the place of, the grade having been raised that much. The iron work and erection was done by the Detroit Bridge & Iron Works, Detroit, Mich., the masonry being done by the railroad company's own men; cost, including raising of grade line on approaches to the bridge, about \$18,000. New water stations have been established at Winthrop, Ind., on the Brazil division, and Walnut Grove, Ind., on the Terre Haute division. At Muncie Junction an extension of six additional stalls was made to the roundhouse; also a cinder pit with depressed track was built to hold cars on which to load cinders. This pit is built with a solid masonry wall on the outside, capped with a light stick of timber under the rail, the other rail being carried on "I" beams so as to admit of access to the pit, the bottom being paved with fire brick.

East Tennessee, Virginia & Georgia.—This road, which was leased to the Richmond & Danville road at the time of the consolidation, is now operated by the Southern R. The terms of the old lease require the payment of dividends of 5 per cent per annum on the stock as a minimum rental, of 6 per cent per annum when the gross earnings exceed, as is now the case, \$1,500,000 and of 7 per cent per annum when they exceed \$2,000,000. This lease, while never formally assumed by the Southern R. Co., is considered to have been practically assumed, it having been subject to "constructive ratification," all thought of modifying the rental, as suggested at the time of the Richmond Terminal reorganization has, it is understood, been abandoned. Dividends aggregating 6 per cent yearly have been paid regularly since September, 1890.

Elmira, Cortland & Northern.—This road, which is 139 miles long, and has been in the market for several years, has become the property of the Lehigh Valley Co., through a sale privately conducted in the office of Mr. Austin Corbin, in New York City. The entire capital stock of the road was acquired from Austin Corbin, J. Rogers Maxwell and Henry W. Maxwell, and the Lehigh Valley takes possession at once. The date of the sale is fixed at Jan. 1, 1896. The road is capitalized at \$2,000,000 common stock, and has a funded debt of \$2,000,000. The bonds securing this indebtedness are of two classes, viz.: \$750,000 first mortgage 6 per cents and \$1,250,000 first mortgage 5 per cents. Mr. J. Rogers Maxwell is credited with saying: "The entire capital stock of the Elmira, Cortland & Northern is bought by the Lehigh Valley R. Co. for a nominal consideration. The road last season paid for all the interest on its bonds, and also paid for various improvements, so that the Lehigh Valley gets a very good property." Under the terms governing the purchase the interest on the funded debt of \$2,300,000 of the acquired property is guaranteed by the Lehigh Valley. The road will hereafter be known as the Elmira branch of the Auburn division of the Lehigh Valley road, and there is some talk of extending the line to Watertown.

Hazelhurst & Southeastern.—The Hazelhurst & Southeastern is the name under which a company has been incorporated in Wisconsin by which a line 13 miles in length from Hazelhurst to Hazelhurst Junction has been built and also a line four miles in length running to the lumber camps at Caton Lake and called Yawkey's spur. The incorporators are W. C., W. H., and C. C. Yawkey, A. J. Ames and J. W. Ferndon all of Hazelhurst. Capital stock \$100,000. Mr. C. C. Yawkey is general manager of the new line.

Houston Belt & Magnolia Park.—An order has been issued by the state court of Texas directing the sale of the property of this company under foreclosure, sale to take place on Tuesday, April 7. The property consists of 5½ miles of Belt road at Houston with switches and sidings two dummy engines and five coaches. The company's terminal property in Houston is in the center of the city and is quite valuable. This road is now leased to the Galveston, La Porte & Houston, which is also operated by receivers. This lease expires on April 4.

Jacksonville, Tampa & Key West.—The date for the sale of this road under foreclosure has been set at April 6 and an order for same has been issued by Judge Locke of the United States court. The upset price, however, has been changed from \$300,000 to \$350,000, which must be paid into the registry of the court in cash before the confirmation of

the sale and the delivery of the property. All bidders on the property will be required to deposit with the special masters, who are to make the sale, \$25,000 in cash, or a certified check for that amount on a responsible bank. The property to be sold includes the main line of road from Jacksonville to Sanford; the branches to DeLand and to Titusville; all sidetracks, turnouts, depots, stations, terminals, rights of way, lands, etc., but not the lands granted by any act of the state legislature. A Florida paper says: "It is generally conceded that H. B. Plant wants the road and that he generally gets what he wants when it comes to railroad matters. The Plant system's southeastern terminus is Jacksonville, but his system begins again at Sanford and continues to Tampa. The connecting link is the Jacksonville, Tampa & Key West R., and if this road belonged to the Plant system there is little doubt but that all of the business of the road from the east would be done via Jacksonville instead of via Dupont and High Springs and the west coast route. The upset price of \$350,000 looks like a small sum for which to sell a railroad of 125 miles of main line besides its branches, sidetracks, etc., but when it is remembered that there are two large mortgages hanging over the road it can be seen why it is not such a bargain after all. The sum of \$350,000, which is to be paid in cash, is for the purpose of paying the receiver's certificates that are unpaid, operating and court expenses, costs, etc."

Little Rock, Hot Springs & Texas.—In compliance with the application for a receiver for the Little Rock, Hot Springs & Texas R., which was made by Johnson & Hansen, contractors, of San Antonio, Tex. Mr. J. S. Lonsdale, of Hot Springs, has been so appointed and the road (known as the Lott road) has been placed in his hands, his bond being fixed at \$10,000. All creditors are directed to intervene in the causes that their claims may be adjusted, and all persons are enjoined from interfering in any way with the assets of the road. Johnson & Hansen's claim consists in work performed in the construction of the road, and amounts to \$80,000. Uriah Lott the projector of the road, has expended about \$300,000 in building the railroad, and there is a debt of \$175,000 still hanging over the company. The assets consist in the right of way from Benton to Hot Springs, two engines, 125,000 cross-ties, 400 tons of steel, of which four miles has been laid, and other property used in building.

Louisville & Nashville.—Proceedings have been instituted in the circuit court at Montgomery, Ala., by the state of Alabama against the Louisville & Nashville R., seeking to vacate the charter of the Selma & Pensacola R., formerly the Selma & Gulf R. For many years this branch of the Louisville & Nashville system has been completed from Selma to Pensacola excepting a gap of 30 miles between Repton and Pine Apple. In 1893 the Alabama legislature passed an act requiring the governor to commence proceedings to vacate the charter unless the line was completed within two years from that time. It has not been completed and in accordance with the act, Governor Oates has commenced the proceedings. It has been reported that the citizens of Pine Apple are willing and anxious to build this needed track if the Louisville & Nashville will operate it. The agents of the company say no notice of suit was served upon them and it is not known what the defense of the company will be.

New York, Pennsylvania & Ohio.—At noon on Feb. 25, the New York, Pennsylvania & Ohio was sold at Akron, Ohio, by Receiver John Tod of Cleveland, under order of the courts of Summit county, Ohio, and Crawford county, Pa. As this road has for years been operated as a part of the Erie system, its sale will in no way change the manner of its future operation. As soon as bids were asked for, Mr. H. B. Turner of New York City stepped forward and offered \$10,000,000, the minimum price fixed by the courts. The bid was immediately accepted and the road declared sold. Mr. Turner made the purchase in the names of Roswell G. Ralston and C. C. Mason, who in turn are a committee appointed by the first mortgage bondholders, whose claims amount to \$74,000,000. The total indebtedness is \$150,000,000. The first mortgage bondholders will receive by agreement \$1 in bonds of the company for every \$5 of the old, and a share of common and preferred stock. The second and third mortgage bondholders will get even less return. As soon as the deeds are filed, the road will be transferred to the newly organized Erie Railway Company. A certified check for \$100,000 was paid by Attorney Turner to Commissioner Tod. The New York, Pennsylvania & Ohio extends from Salamanca, N. Y., to Dayton, O. It was completed in 1864 and has been operated by the Erie since 1883.

Northern Pacific.—The Northern Pacific Railroad Co. will make extensive dock improvements at Duluth this spring. About \$50,000 will be spent. The new docks will contain two new warehouses each 80 x 600 ft. in size, constructed of corrugated iron and asphalt roofs. These buildings will have an advantage over all other similar structures here in that the sides nearest the railway tracks may be raised in sections or entire, to admit if necessary, of the handling of freight directly to or from the car or warehouse. Another improvement which this road will make this season is that of filling in the company's bridge across the St. Louis River between Duluth & Superior as far as the government will permit. The filling will extend to the dock line from either shore and 100,000 yds. of material will be required. The entire length of the bridge is 5,605 ft.

Oregon Railway & Navigation Co.—The plan of reorganization of the Oregon Railway & Navigation Co. is now operative. Deposits of consolidated mortgages and collateral trust bonds will continue to be received up to Feb. 29 without penalty. After that date a payment of \$50 per bond will be required. Deposits of stocks will be received up to the same date on payment of \$6 per share.

Ottawa, Arnprior & Parry Sound.—The contract for the last 47 miles of the Ottawa, Arnprior & Parry Sound R., awarded to E. F. Fauquier, of Toronto, has been sublet as follows: D. D. McDonald, Whitney, Ont., first 10 mile section east end; O'Neil & Ferguson, second 12 mile section, and Poulin & Fitzpatrick, Emsdale, Ont., the first 15 mile section on west end of line. Surveys are completed and the work of cutting right of way, trestles across bays of lakes and some rockwork is now going on, there being about 400 men employed at the present time. The above

contracts are for substructure only and are to be completed during the month of September. Bridging, track-laying and ballasting is done by the company and will be pushed to completion so that the road may be open for traffic before January 1, 1897.

Panama-Pacific Mail.—It is said that the contract entered into on December 1 last between the Panama R. and the Pacific Mail has not proved altogether successful and that plans are now afoot to confront President C. P. Huntington, of the Pacific Mail Steamship Co., with a demand that the contract be annulled. By that contract the Panama R. was to do the Atlantic coast steamship service with the ships *Allianca*, *Advance* and *Finance*, while the Pacific Mail boats were to have the exclusive service on the Pacific coast. The following taken from a New York paper explains the present disagreement: "Almost immediately the Panama people found that they were getting no freight from the Pacific Mail boats at Panama and matters reached a crisis when the *Allianca*, a 2,700 ton steamship, came into this port last week without a single ton of freight via the Panama R. She was so top-heavy and light that she came near foundering. The officers protested against such risks and the matter will probably come before a United States court. Other Panama steamers on this side have been similarly treated. Meantime the Morgan liners were very heavily laden and the San Francisco agent reported that all freight was being diverted over the Southern Pacific route via New Orleans. The excuse given by the Pacific Mail people for not delivering the freight to the Panama R. at Panama was that there was so much freight for points between San Francisco and Panama that when the steamers reached the latter point they were empty. It is said that the upshot of the fight will be the re-establishment of the Panama through line."

St. Joseph Valley.—Nearly 18 months ago the St. Joseph Valley R. Co. abandoned its line of railroad between Buchanan and Berrien Springs, Mich., and residents along the line of the road have petitioned Railroad Commissioner Billings to have the company's rights forfeited so that the right of way can revert to the former owners. It is charged that the line has been abandoned for railroad purposes and the forfeiture thus worked. The officials do not wish to abandon their investment as they hope some day it will be wanted as a feeder to some of the larger railway system, and so they keep an engine and a flat car which they run over the road occasionally, but which furnishes no service to the public. The commissioner does not see his way out of the dilemma, and it is a serious question with him whether the non-action of the railroad company yet amounts to an abandonment of the road.

San Francisco & San Joaquin Valley.—A claim has been filed by the San Francisco & San Joaquin Valley R. to obtain the 70 per cent due on a subscription to the capital stock. The estate of Joseph A. Donohoe subscribed for 250 shares of the railroad stock at \$25,000, and it is said that there is still due on the subscription \$17,500. This sum is asked for. A contract has been awarded to Grant Brothers for grading the line from the Tuolumne River to the Merced river, a distance of about 20 miles. The contract provides that the grading is to reach the Merced river in two months. With this new section of line completed there will be 55 miles of road in working order, exclusive of side tracks and yard tracks at Stockton.

NEW ROADS AND PROJECTS.

Alabama.—The negotiations which have been pending to secure capital to build the Mobile, Jackson & Kansas City road are said to be concluded in a satisfactory manner. The condition is that local aid is secured to the amount of \$250,000, and then New York and English capitalists will make up the required amount. The proposed road is to run from Mobile, Ala., to Jackson, Miss., and the officers are as follows: F. B. Merrill, of Mobile, is president and general manager; H. Austill, of Mobile, vice president and general solicitor, and Ralph G. Stratton, secretary and treasurer.

British America.—In the legislation at Winnipeg, Manitoba, last week, notice was given by Premier Greenway that he would move that aid be granted the Lake Manitoba Railway & Canal Co., to assist in the construction of a line from Portage la Prairie or adjacent point to the Lake Dauphin country, west of Lake Manitoba. It is proposed that the province shall guarantee the principal and interest of the first mortgage bonds of the company to the amount of \$8,000 per mile. The proposed road will be about 100 miles in length, and is greatly needed to tap one of the richest portions of Manitoba.

California.—The new line which is to be built from Stockton to the Corral Hollow coal mines is to be called the Alameda & San Joaquin. The contract for building this railroad is reported awarded to John Kelso, and work is to begin this week and the grading is to be completed by April. The local papers give the following as the prices at which the contract was awarded: Grading, solid rock, 30 cents a cubic yard; grading, loose rock, 18 cents; excavating gravel, 10 cents; excavating earth, 10 cents; borrow embankment, gravel, 8 cents; borrow embankment, earth, 8 cents; clearing, where actually done, \$25 an acre; grubbing, where actually done, \$5 a station; overhaul, at the rate of 1 cent a cubic yard for each 10 ft. in excess of 600 ft.; riprap, at 60 cents per cubic yard. Hugh Fox is superintendent of construction and George A. Atherton, of Stockton, is chief engineer.

Idaho.—The contracts for the Boise, Nampa & Owyhee, the incorporation of which was noted in this column last week, are, according to reports, about to be let and Mr. Fremont Wood the attorney for the company at Boise is quoted as saying: "Work will at once be commenced to complete the right of way from Nampa to Snake River. The larger portion has already been secured. The company will first grade the road to Snake River, a distance of 18 miles. Arrangements have been made to float the bonds for the entire road as soon as the company secures right of way and completes the grade to Snake River. The grading contracts for the first 18 miles will be let in a few days. The road will cross Snake River about two miles from Walter's Ferry, and, as soon as complete to that point, the business of the great Owyhee mining district

will then be directly tributary to Boise. A connecting contract with the Oregon Short Line here has already been secured from the receivers, and the proposed road will be operated as a branch to the Union Pacific."

Illinois.—Articles of incorporation of the St. Louis, Peoria & Northern R. Co. have been filed for record in the office of the recorder of deeds at Springfield. The proposed object is to construct a railroad from East St. Louis through the counties of St. Clair, Madison, Macoupin, Montgomery, Sangamon, Logan, Mason, Tazewell, Woodford, Peoria, Stark, Henry, Rock Island and Whiteside to a point on the Mississippi river opposite Clinton, Ia. The directors are: H. R. Durkee and J. S. Brewer, of Chicago; William F. Niedringhaus, William E. Guy, William E. Huse, George E. Carpenter and C. D. McLune, of St. Louis; Louis Kalb, of Marine, Ill.; E. W. Guy, of Belleville, Ill., and Clinton Conkling and Joseph M. Grout, of Springfield. This road is intended as an extension of the St. Louis & Eastern R., and the headquarters are to be at Springfield. Capital stock, \$5,000,000.

Kansas.—A project is being talked up to build an independent line from Wichita to Parsons to connect with the Ft. Scott road and also the M., K. & T. The people of this section refuse to ship corn at the advanced rates recently put into gulf points, and have little faith that the Interstate Commerce Commission will compel the restoration of equitable rates. The people of the eastern part of the state are now getting a 5 cent better rate south over the above lines than can be had in this territory. The proposed connection would give Central Kansas a better market for grain and bring cheaper coal. Efforts are being made to have the Wichita Commercial Club undertake the proposed line.

New Mexico.—The proposition to build a line from Deming, N. Mex., into the northern part of Old Mexico and thence to the Pacific coast is again being agitated, and it is said the franchises have been secured by B. C. Faurot, of Lima, Ohio, and others. Considerable work was done on this line a few years ago by John W. Young and other Utah people in connection with a project for locating a Mormon colony in northern Mexico. The Mexican government has granted the company a subsidy of \$15,000 a mile and it is stated that Mr. Faurot and a Major Kirkland have agreed to build 100 miles of road within the next two years.

It is stated that engineers will again be in the field this week to complete the survey for the extension to the Pecos Valley road which is projected to run from Roswell, N. M., to Washburn, Tex., a distance of 200 miles.

The contract for 180 miles of the projected Fort Worth & Albuquerque road is said to have been let to John P. Hughes, of Fort Worth, Tex. This road was begun in 1890, about 12 or 15 miles from Fort Worth north having been graded at that time when work was abandoned.

Ohio.—Under the name of Ironton, Columbus & Toledo, a company proposes to build via Columbus, a line from Ironton to Toledo. The new road will have its southern terminus at Ironton and will run from that point through the Waterloo coal fields in the back part of Lawrence county, thence via Columbus to the lake, paralleling one of the other lines running from Columbus north to Lake Erie. The company has acquired the right and franchises of the Ironton & Northeastern, which was chartered 15 years ago, and expects to follow the route laid out by that proposed line. Mr. F. J. O'Connell, of Ironton, is the projector.

It is said that the rumor that the Akron & Cuyahoga Falls Rapid Transit Co. would extend its lines to Cleveland has been confirmed by General Manager T. F. Walsh. The new road will be built westerly and northerly from the city probably, while the Akron, Bedford & Cleveland line now in operation, runs easterly and then north. Another route the Rapid Transit Co. has in view is via Kent and Brady's Lake, the famous resort of the Spiritualists. Over \$500,000 has been voted to improvements and extension by the rapid transit stockholders.

Oklahoma.—It is stated that the general manager of the projected Hutchison, Oklahoma & Guthrie R., which is to be built from Cameron, Kan., south through Oklahoma to Guthrie, and thence southeast to Chandler and the Texas state line, is authority for the statement that contracts for some of the construction material are already given out and that the actual work of construction will begin early in April.

Pennsylvania.—The Allegheny & Western R. Co. has been incorporated and has been granted a charter to build a road 63 miles in length from a connection with the Jefferson & Allegheny near Musgrove to a connection with the Pittsburgh & Western at New Castle Junction. The directors are nearly all Ridgeway men, and are as follows: W. W. Ames, M. F. Hammond, J. H. Ralph, G. W. Child, M. K. Williams, H. L. Moore, John G. Whitmore, S. A. Rote, J. N. Trexell, W. H. Holliday, and G. T. Chapin. Mr. W. W. Ames is president.

Texas.—The right of way for the Dallas & Fort Worth, which is to be an electric road connecting these two cities—a distance of 32 miles—has now been secured and reports are to the effect that work will begin on March 1. It is expected to float bonds in England, as English capitalists are said to be favorably impressed with the practicability of the proposed line. It is proposed to run trains between Dallas and Fort Worth at intervals of from one to two hours.

Wyoming.—The Wyoming & Black Hills R. Co. has been organized at Sun Dance, Wyo., to build a railroad from Spearfish, S. D., to Sun Dance in order to reach the rich coal fields in that vicinity. The trustees of the new line for the first year are Henry M. Cutler of Boston, Valentine Baker of Cheyenne, and Alpha E. Hoyt of Sun Dance. Capital stock, \$3,000,000.

INDUSTRIAL NOTES.

Bridges.

—The steel arch bridge which is to replace the suspension bridge at Niagara Falls will consist of a main arch span 840 ft. long and two shore spans. That on the American side to be 190 ft. long and the span on the Can-

adian side to be 210 ft. in length. The arch span will consist of an open parabolic rib 26 ft. in depth, with a rise of 105 ft. at the center. The roadway will be 46 ft. in the clear.

—The town board of Long Branch, N. J., has granted a franchise to the Atlantic Coast Electric Railroad Co. to build a line 14 miles long to Asbury Park, which will require, it is stated, a bridge 1,200 ft. long.

—At 5 o'clock on the evening of February 24, the last span of the new steel bridge across the Missouri river at this city was contemplated. As stated last week the approaches are yet incomplete, but a large force of men is at work and in a short time the bridge will be open for traffic.

—The county commissioners of Burke county, N. C. have voted to build another iron bridge over the Catawba river.

—New Decatur, Ala., has petitioned congress for permission to build a pontoon bridge over the Tennessee river.

—The United States senate has passed the bill for a memorial bridge across the Potomac, appropriating \$100,000 for the preliminary surveys. It will probably be located between the long bridge and Georgetown.

—The county court will decide at its special session in April whether the bridge which is to be erected over the Tennessee river at Knoxville shall be iron or steel. The bridge was recently authorized, and \$225,000 in bonds will be issued to pay for it.

—The two widely known corporations, known respectively as the Philadelphia Bridge Works, (Cofrode & Saylor, incorporated) and the Reading Rolling Mill Co., have emerged from the difficulties under which they have been laboring and are again on a solid basis with their properties and affairs under their own control. These concerns although distinct corporations, are controlled by the same people and are under the same management, as follows: Francis H. Saylor, who is president of both corporations; George W. Corbett, business manager; Livingston Saylor, superintendent of the bridge works; J. L. Rake, general manager; and W. H. Lutz, superintendent of the rolling mills.

—The contracts for constructing the Inter-Urban railway bridge across the Saginaw river at Saginaw, Mich., have been awarded as follows: Sub-structure including foundation, piers and trestle work to John H. Qualman and M. C. Heineman, of Saginaw, the superstructure of bridge going to the Detroit Bridge & Iron Works. There will be six stone piers, one being a circular pivot pier under the draw span. The bridge will consist of one draw span 236 ft long with 96 ft. clear channel each side of the center pier. There will be three fixed spans 156 ft. 11 in. each and trestle approaches from each shore. The entire structure will be of steel and designed to carry the heaviest steam railway traffic. The drawbridges will be operated by electricity and the entire cost of the structure will be \$75,000. Work will be commenced at once and the contract calls for the structure to be completed June 15. Charles C. Rothfield, Detroit, consulting engineer, drew the plans, and is in charge of the work.

—It is stated that the Canadian Pacific Railway Co. is to build a bridge on the east side of York street, in Toronto, Ont. The structure will consist of 33 spans of 20 to 68 ft. in length and will be about 592½ ft. wide. The foundation will be of stone and piling.

—The Chicago & Northwestern will make improvements in the vicinity of Boone, Ia., that will cost \$500,000. The road after leaving Boone, instead of going down into the valley of the Des Moines river will follow the ridge which strikes the river north of Moingona, where a bridge will be erected 120 ft. higher than the present grade. It is said that work will be commenced in the early spring.

—The auditors of Page, Johnson and Montgomery counties located at Clarinda, Iowa City and Red Oak, Ia. are asking for bids all iron and steel bridges needed during the current year. Bids will be received until April 8 except for Johnson county which will close April 6.

—The false work used in the rebuilding of the Chicago, Rock Island & Pacific Railroad bridge between Rock Island and Davenport was carried away by the accumulation of ice Feb. 25. The contract for the work was taken by the Phoenix Bridge Co., and it was expected that the river span would have been completed before the opening of navigation. The accident is a serious one and may prove a temporary obstruction to navigation. Pending the building of new false works the trains of the road are running over the C. B. & Q. and C. M. & St. P. tracks around the break.

Buildings.

—Messrs. McRae & Roberts, of Detroit, are building a new brass foundry that will be four times as large as their present plant. The main building is 310x90 ft., three stories and basement.

—The Pennsylvania Company is considering the enlargement of its freight depots at Indianapolis, the present buildings being inadequate to the business. In the last 10 years the business of the Pennsylvania lines at Indianapolis has more than doubled, and every year is showing a large increase in local tonnage over preceding years. The Pennsylvania people had hoped to make some arrangement with the Big Four by which they could acquire the old Bee Line freight depot just east of the viaduct and extend their present depot eastward to New Jersey street, but have been unable to accomplish anything in that direction. It is not improbable that they will build on South street, the building running along Delaware down to Merrill street. It is stated that the company has options on the additional ground which will be needed. The whole matter at the present time, however, is in an unsettled state.

—The Richlands (Va.) Iron Co. will, it is stated, erect a plant at Alexandria, Ind., for the manufacture of steel rails. About 400 men will be employed.

Cars and Locomotives.

—The stockholders of the Indiana Car & Foundry Co. held their annual meeting at Indianapolis a short time ago. The old directors and officers were re-elected: Maj.

Collins, president; Emil Pollak, secretary, and J. K. Pollock, treasurer.

—The United States Car Co., of Anniston, Ala., is reported to have secured a contract to furnish axles for all of the repair shops of the Southern Railway Co. For many years the axles made in Anniston have been noted for their durability, and it is but a well deserved compliment to the character of the work turned out at these shops that such an order should have been given.

—Capt. Thos. L. Casey, U. S. engineer, will receive bids until March 16 for furnishing and delivering a locomotive, steel rails, etc., at Ft. Monroe, Va.

—The Pittsburgh Locomotive & Car Works state that the order for locomotives lately received by them from the Lake Superior & Ishpeming Railway Company is for eleven engines; five 19 x 24 in. six wheel switchers; two 20 x 26 in. simple consolidations, and four 20 x 31 x 28 compound consolidations.

—Some of the parlor cars ordered some time ago by the C., C. & St. L. of the Barney & Smith Car Company have been delivered and put in service on trains running between Cincinnati and Chicago.

—The Pullman Company is reported to be building seven new sleeping cars for service on the Chicago, Rock Island & Pacific.

—The Central Vermont is said to have placed an order for 13 passenger cars with the Jackson & Sharp Company, Wilmington, Del.

—The Calumet & Blue Island Railroad Co. is taking bids on 300 box cars of 60,000 lbs. capacity.

—It has been stated that the Houston & Texas Central is in the market for 1,200 cars. We understand, however, that it is for trucks instead of for complete cars.

—The Wells & French Co. have the contract for furnishing all the air brake material (except that furnished by the Westinghouse Co.) and the yoke pockets and other attachments for the M. C. B. coupler for 5,000 cars for the Chicago & Northwestern road.

—The Union Car Co., of St. Louis, has been organized with capital stock of \$50,000, one-half of which is paid up, and the remaining half will be paid up shortly. The factory will be located at Baden, in the northern part of the city, where the company owns 16 acres of ground. The officers are Henry W. Rocklage, president; Henry P. Wehrenbrecht, vice president; Charles Knickmeyer, secretary and treasurer.

Iron and Steel.

—The Union Steel Co. of Alexandria, Ind., has not yet started its Bessemer converting department. The other departments of the work are running full double turn, except the sheet mill, which is running triple turn.

—George B. Sennett of the Eagle Iron Works, Meadville, Pa., denies that he is to remove to Youngstown, O., as reported last week. Land valued at \$10,000 has been purchased at New Castle, Pa., it is reported, and the plans are drawn for the plant and for switches and sidings. It is said that the chief reason for choosing New Castle was that the Connolly Gas Engine Works are there and their castings are made at the Eagle Iron Works.

—The American Foundry & Furnace Co. of Bloomington, Ill., has been incorporated with a capital stock of \$120,000 to manufacture foundry supplies. The incorporators are: Clinton P. Saper, Thomas C. Kerrick and Henry D. Spencer.

—Peacock's Iron Works, Selma, Ala., has issued a new catalog devoted to the line of car wheels, axles, car irons and cars of all description, which it manufactures, and will mail copies of same upon application. This company has a fine reputation for the excellence of its product.

—The Whitney Malleable Iron Co., Muncie, Ind., reports that it is very busy in every department. The demand for car couplers which it manufactures is particularly heavy at present.

—As only one of the many indications of an improvement in business, it is stated that the Illinois Steel Co. is so crowded with orders in its plate department that it is holding its prices at a point considerably above the market.

—The Japanese government is said to have arranged for the establishment of a steel foundry in Japan by Sir W. G. Armstrong & Co., Ltd., on the following terms: 1. The material shall for the present be imported from England. 2. Of the workmen to be employed 20 per cent shall be brought from England and 80 per cent shall be Japanese. 3. When a new arm is invented in England it shall be manufactured at the works in Japan. 4. For a stated number of years the Japanese government shall give a fixed subsidy to the company. 5. On the expiration of the period during which the company receives a subsidy the works shall be sold to the Japanese government.

—The new plant of the American Weldless Tubing Co., of Toledo, O., the progress of which has been noted in these columns, will be 215x115 ft., and will have a capacity at the start of 250,000 ft. a month. The first machines will be shipped from England, and are now on the way. At the outset 300 men will be employed, but it is contemplated to increase this force by about 200 more by the first of June. Samuel Snell and Edward Warwick are the chief promoters.

—The Cleveland Wheel & Foundry Co., Cleveland, O., capital \$80,000, has been incorporated by Thomas Maher, Terrence Dalton, Jos. A. Stone, C. A. Brayton, and T. H. Graham.

—It is now understood that the affairs of the Ohio Falls Iron Works of New Albany, Ind., will probably now be wound up, as all parties interested are agreed that material on hand, consisting of large quantities of pig iron and scrap, together with stock of manufactured iron, must be sold out to highest bidders for the benefit of all creditors. J. F. McCulloch of the New Albany National Bank has been appointed receiver and will take possession at once.

—No. A furnace of the Maryland Steel Co., Sparrow's Point, Md., is reported to have made a record recently which it is believed is better than anything done so far in this country on foreign ore, the burden being one-third

Mokta, one-third Tafna, one-sixth Porman and one-sixth Seriphos ore, the yield being 55 per cent in pig. The product for the month of January was 8,675 tons, a daily average of 279½ tons. The best day's work was 321 tons, the best week being 2,019 tons. The average of the last three weeks of the month was 1,999 tons. The fuel consumption was 2,038 lbs. of coke per 2,240 lbs. of iron. David Baker is the superintendent of the furnaces of the Maryland Steel Company.

Machinery and Tools.

The large centrifugal dredge which has been under course of erection at the shops of the Shook-Anderson Manufacturing Co., Pittsburgh, has been completed and shipped to destination. This dredge, which was designed by Mr. Fred E. Youngs, general manager of the Pittsburgh & Cariboo Gold Dredging Co., is of a centrifugal pattern and will be placed on a steam propelled boat to be used in pumping gold from the bottom of the river. The machine is especially designed for plowing up the river bottom so that the suction of the centrifugal pump is made to raise the gold from the surface of the bed rock or clay underlying the gravel. By means of a turn-table and adjustable steel lever this suction pipe is made to swing from the bow of the boat to each side of the river, and will without changing the anchorage dredge 2,000 sq. ft. of river bottom. The equipment of the dredge consists of a pair of double engines of 100 horse power capacity, pair of Columbia compound boilers of 110 horse power capacity, built by the Erie (Pa.) Engine Works, a pair of 6¼x8 O. & S. double cylinder, double drum hoisting engines, and an 8 in. centrifugal sand dredging pump with 25 horse power engine combined. The boat will be placed on the waters of the Frazier river in British Columbia, about 220 miles north of Ashcroft and 200 miles east of Vancouver. A practical test was made last week, and it was found to work perfectly.

F. W. Wheeler & Co., Bay City, Mich., is placing a large amount of machinery in its steel ship-building plant, among which are six electric motors, two 10 ton hoisting derricks, a 10 ton traveling crane, a 10 ton locomotive crane, a 3 ton hoist, angle shear, set of straighteners, set of bending rolls, plate planer, etc.

The Clement Pneumatic Tool Co. has succeeded to the business of Dr. J. F. Clement, 123 to 135 South Eleventh street, Philadelphia, in the manufacture of the Clement pneumatic appliances for calking, clipping, driving rivets, die sinking, submarine and other work. The officers of the company are Thomas Scattergood, president; M. M. Coppuk, secretary and treasurer; Henry S. Robbins is general manager.

John B. Allan, Chicago manager of the Edward P. Allis Co. is authority for the statement that the demand for engines for electric railroad plants is very heavy, especially from the east. He says their New York office estimates that the eastern states alone plan already perfected and maturing call for engines aggregating 200,000 horse power for this purpose. The Allis Works were never so busy as at present, and are daily obliged to decline business because suitable deliveries cannot be made.

Anderson, Du Puy & Co., of Pittsburgh, has recently added the Yerkes Tool Works to its already extensive plant. This department is provided with the most improved machinery for turning out various tools of the highest standard of quality and finish. This company produces its own crucible and open hearth steels. In tempering it uses a new secret process which is claimed to give hardness to that part of the tool where it is most needed, and at the same time leaves the balance solid and tough. Among the tools carried in stock are: Stone and blacksmiths' sledges, striking, spalling and mason's hammers, railroad spike and coal mauls, etc.

Darling, Brown & Sharpe, whose standard rules are known to every machinist, has recently brought out a line of tempered rules which they guarantee equal in accuracy with their standard rules. It is well understood that the degree of accuracy of their standard rules is such that there can be no higher guarantee. These rules have the same variety of graduations as their standard rules and are adapted to all uses.

The general office of the United States Metallic Packing Co. has been removed to No. 427 North Thirteenth street, Philadelphia. The output of this concern consisting of metallic packing for locomotives, marine engines, stationary engines and air pumps, Gollmer locomotive bell ringer, and Chouteau pneumatic hammers occupy a prominent place.

The Brown Hoisting & Conveying Machine Co. of Cleveland, Ohio, is so crowded with orders that the shops must in all departments run 24 hours per day for three or four months, and will then be scarcely able to complete the contracts on time.

The Phoenix Iron Works of Cleveland reports having done the largest business in the history of the company in the year 1895, and prospects for the present year are exceedingly flattering.

The Chicago Pneumatic Tool Co. reports a rushing business. It has 860 pneumatic hammers in the course of construction at the shops in St. Louis, and it is running till 10:30 every night in order to rush the tools out. Inquiries are numerous from abroad for the hammers. Sixty-three have been sent to London, 4 to Australia, 7 to Mexico, 22 to Canada and 2 to Italy. This company has obtained control of the pneumatic sandpapering machine which has been so successful in the Union Pacific shops at Omaha, and 100 of them are being built.

The Sheffield Car Co., whose output of railroad specialties are so well and favorably known has constituted the equally well known firm of Fairbanks, Morse & Co., its exclusive selling agents for its entire line of goods. All orders or inquiries for goods should therefore be addressed to the last named firm. Correspondence concerning their manufacture can be still done with the Sheffield Car Co., Three Rivers, Mich.

Mr. John C. Wand, of St. Louis, is making preparations to put his wrought steel bolster on the market in the near future, and if the reported results of experiments are any criterion this bolster will be a winner. Mr. Wand has designed a truck in which the bolster is used and has received orders for 140 of them for experimental purposes. Present indications are that the various designs of truck

bolsters on the market will soon be as numerous as those of the M. C. B. coupler. St. Louis seems to be particularly productive of designs in this line and a car builder who cannot find a design to his liking is surely hard to please.

The Detroit Lubricator Co. of Detroit reports the business of the year 1895 as being by far the largest the company has ever handled.

The Missouri Malleable Iron Co., is doing considerable railroad work. At the present time 104 brake heads per day are being turned out for the Clover Leaf, and the castings for 500 Mexican Central cars are being run through. In addition to this several small orders are on hand. The works of this company located at East St. Louis is as complete and well equipped a plant as is often seen, and it is claimed that the floor of the foundry is the largest single floor in the United States. The annealing ovens are all heated by gas the supply being furnished by producers connected directly with the furnaces. It is claimed that this method of heating gives excellent results as an even temperature in the ovens is assured at all times. The buildings composing the plant are all of brick and first class in every respect. The pattern loft is a model of neatness and order, practically fire proof and is only one of many indications that the works are ably managed.

Miscellaneous.

The Chicago Great Western Railway Company has asked for bids on about 375,000 cubic yards of grading necessary to reduce grades on the Chicago division of its main line between Stillman Valley and Holcomb, German Valley and Myrtle, between Esmond and Clare and west of South Freeport. The contract for building 56 stone culverts ranging in size from 2 x 3 box to 8 x 8 arch, has been let to Mr. T. H. Houston, of Minneapolis, Minn. There will be about 6,300 cubic yards of masonry in the work. These culverts will take the place of 8,406 lineal feet of pile bridging which will be filled up as soon as the culverts are completed. It has been found that the most satisfactory and cheapest way of building the stone culverts is for the railway company to furnish quarry, sand and cement and for the contractor the tools and labor.

Specifications are soon to be issued by the Union Elevated Loop Railroad, Chicago, for its power house equipment. The plant is to be located on the river just south of Van Buren street. According to reports it will contain four 2,000 horsepower cross-compound condensing engines, probably vertical with electric generators direct connected. As the lot upon which the station is to be built is comparatively small, the boiler plant will have to be installed directly over the engine and dynamo room. Water tube boilers will be called for.

The new shops of the Big Four in Wabash, Ind., have started up in all departments. There are several larger shops in the country but none more complete in every respect, all the new machinery being of the most modern type. In convenience, comfort and facilities to turn out work these shops are difficult to excel.

The Westinghouse Electric Co., Pittsburgh, has secured the contracts for the electric equipment to be used on the Columbia & Maryland Railway, being constructed between Baltimore & Washington. Each of the power houses will be one story high and 120x250 ft., to have a capacity of 3,000 horsepower each. One at Ilchester on the Patapsco river, will probably be built of stone, and the other, near Hyattsville, Md., of brick. The American Stoker Co., Dayton, O., has secured a \$24,000 contract to supply its system to the two plants.

Several Pittsburgh parties are said to be negotiating for the purchase of the Crescent Glass Company's property at Washington, Pa., which will be greatly enlarged and transformed into a tube mill.

The Q. & C. Co. of Chicago, manufacturers of metal sawing machinery, railway supplies, etc., have decided to move its factory to Chicago Heights, Ill., having purchased the plant of the Abbott Machine Co., located at that point. It will at once erect a machine shop 60x210 ft. and a foundry 75x150 ft. Heretofore its castings have been made in Bridgeport, Conn., and shipped to its works here. When the new plant shall have been completed all such work will be done here. Architects Hubbell & Smith are at work on the plans and contracts for the buildings will soon be let.

The Maryland Construction & Contracting Co. has been formed at Baltimore, Md., with a capital stock of \$1,000,000, for the purpose of doing a contracting and constructing business. The proposed incorporators are Alfred A. Glasier, Nicholas P. Bond, Edward Duffy, Edward L. Bartlett, G. H. Campbell and Edmund T. Moulton.

Messrs. Lowry & Day of Lexington, Ky., have compiled an estimate of the Kentucky output of railroad ties as follows: Eastern Kentucky—Big Sandy River, 250,000; A. C. & I. R. R., 70,000; E. K. R. R., 100,000; Little Sandy river, 75,000; Tygart creek, 150,000; Ohio river (upper), 100,000; C. & O. R. R., 250,000; L. & E. R. R., 300,000; R. N. I. & B. R. R., 50,000; L. & N. R. R., 100,000; C. S. R. R., 125,000; total eastern Kentucky, 1,570,000. Western Kentucky—L. St. L. & T. R. R., 200,000; C. O. & S. W. R. R., 150,000; A. F. & R. G. R. R., 100,000; P. T. & A. R. R., 250,000; Ohio Valley R. R., 150,000; Green river, 300,000; Cumberland and Tennessee rivers, 400,000; lower Ohio river and creeks, 500,000; small roads, 400,000; total western Kentucky, 2,450,000; grand total, 4,020,000. These ties cost the railroads an average of 50 cents each, so it will be seen that Kentucky's tie output brings into the state about \$2,000,000 yearly. The firm of Lowry & Day handles 750,000 ties every year. The other large oak tie firms of the country are located outside of Kentucky. C. B. Lowry of the firm of Lowry & Day, says the enormous consumption of ties will soon use up all the available timber, and that the railroads will have to look to something besides wood for their ties in the near future.

The Westinghouse closed conduit system has been recommended by Dr. John Hopkinson, the expert to whom the subject was referred, for use on the extension of the Leeds tramways.

In the vicinity of Portage, on the Pennsylvania road, where one of the largest contracts let for years has been commenced, is just now a very lively place. From Lilly

to Portage, a distance of four miles, the work is of a prodigious nature. The new line will veer away from the old line now in use from 200 to 500 yards, and will be nearly a bee line all the way. Enormous cuts, 60 ft. deep and 1,000 ft. long, will be necessary, with fills from 50 to 70 ft. at both ends. The roadbed will be made wide enough for at least three tracks. At one place the new line runs through a hill containing a valuable bed of coal.

As an example of the expansion of our export trade for manufactures, the Manufacturers Record notes that the cargo of the steamer Ardandhu, one of the largest steamers plying between this country and Central America, was comprised of four large 65 ton compound locomotives, one switching locomotive, two passenger cars and 60 freight cars, all shipped to Jamaica, West Indies, by the New York Equipment Co., of 80 Broadway, New York. It was bought for use on the Jamaica railway, now being completed by James P. McDonald & Co., of New York City. The same company subsequently made another large shipment of railway material to Jamaica. This cargo included about 1,000 tons of heavy bridge girders. Being too large to be carried as a whole in the regular steamships running from the West Indies, a special steamer, Foscolia, had to be chartered to convey this product of American mills to a country practically owned and controlled by the English. This railway material and these bridge girders are to be used in the extension of the Jamaica railway east to Port Antonio.

Henry S. Leach, manufacturer of the Leach locomotive sand blowers, broke the sales record last month. He sold 113 sets. The largest number, 25 sets, went to the Boston & Maine, the next largest, 21 sets, being for the Norfolk & Western. He now has 2,478 sets in service.

The new roofing material invented by a Mr. Kohler, of Limbach, Saxony, after a test of several years is now being largely used. It is reported to be made of 1 part cement to 3 parts of sand and gravel molded into the form of a tile which has ridges on the bottom fitting into grooves in the top of the under tile. These tiles are fastened by nails only. It is very cheap and weighs 76 lbs. per square yard. It is durable, fire, wind and waterproof. Two establishments in Germany have already turned out nearly 20,000,000 of these tiles in the last few years. It looks as well as slate, and is said to be as durable as well as cheaper and easier to put in place.

A new kind of fuel is being tried in Boston. It is made of Mexican asphalt and peat and turf, compacted and baked together. There are said to be exhaustless deposits of bitumen or asphalt in Mexico, which the people there have attempted successfully to burn, but it would melt and run and thus give trouble. Mr. Geo. J. Altham, of the New England Turbine & Fuel Co. of Boston, experimented with it and found the running could be prevented by making a certain composition of it with peat. The fuel was tried on Feb. 7 at the headquarters of the Boston fire department by running a fire engine with it. Steam was gotten up quicker and held a higher pressure while the engine was operating than was possible with cannel coal, with a smaller consumption of fuel for a given amount of work.

The Merrill-Stevens Engineering Co., Jacksonville, Fla., is reported to have designed and built since 1892 four composite steamers, seven steel steamers and four wooden steamers, varying in size from 500 to 700 tons. It is said that this firm since its organization, nine years ago, has done 70 per cent of all the marine work between Savannah and Pensacola.

The Glazier Headlight Co., of Rochester, N. Y., reports a rapidly increasing business, requiring an extra force to handle the orders now coming in. The Algee-Stevens-Clark Co., of Atlanta, Ga., has been recently appointed southern agent for the Glazier Co.

The National Switch & Signal Co. has been awarded the contract for installing six interlocking plants on the Lima Northern Railroad in Ohio at the following points: Lima, Malinto, Hamler, Ottawa, Lipsic and West Lipsic. The Lima Northern is a new line under construction and while the crossings are in at these several points, the operation of traffic over them is dependent upon a proper protection of each crossing by a suitable system of interlocking. The following argument has been received from the company mentioned. "The opposition to the making of a grade crossing is now frequently compromised by the new company in offering to install and maintain a complete system of interlocking, and when the new company will take upon itself this cost there is generally no occasion for condemnation proceedings and other heavy court costs. It is conceded by railway managers familiar with the protection offered by the modern system of interlocking that it avoids the large cost of separating the grades of tracks at crossings and provides for a more prompt exchange of traffic between the roads, at the same time offering all the protection of a separate grade crossing. The mere separation of tracks at a crossing is not always sufficient to protect the traffic for the reason that frequently interchange of business between the railroads requires some connection which is usually accomplished by 'Y' tracks. If this is not protected by an interlocking plant there is still the ever-present danger of accident through collision by means of open switches on these 'Y's' or connections, and since the operative cost for maintaining the larger interlocking plant which would be necessary in case the grades were not separated is not greater than in case a smaller interlocking plant was put in simply to protect the 'Y' connections, it is apparent that the introduction of a complete interlocking system solves the problem of grade crossings; for, while in all cases the expense of separating the grades is considerable, the majority of dangerous crossings are so situated as to make it impracticable to separate them."

The Railway Supply Company of St. Louis has been organized with the following officers: President, A. Butze, vice-president, John S. Manchester; secretary and treasurer, W. E. Butze. The company has located at No. 11 North Sixth street, St. Louis, Mo., where a full stock of railway supplies may be found. Mr. Adolph Butze, president of the new concern, was formerly purchasing agent of the Louisville, New Albany & Chicago road, but has more recently been conducting a railway supply business in St. Louis. Mr. Manchester has been connected with the M. M. Buck Manufacturing Company and is thoroughly posted in all details of the railway supply business.